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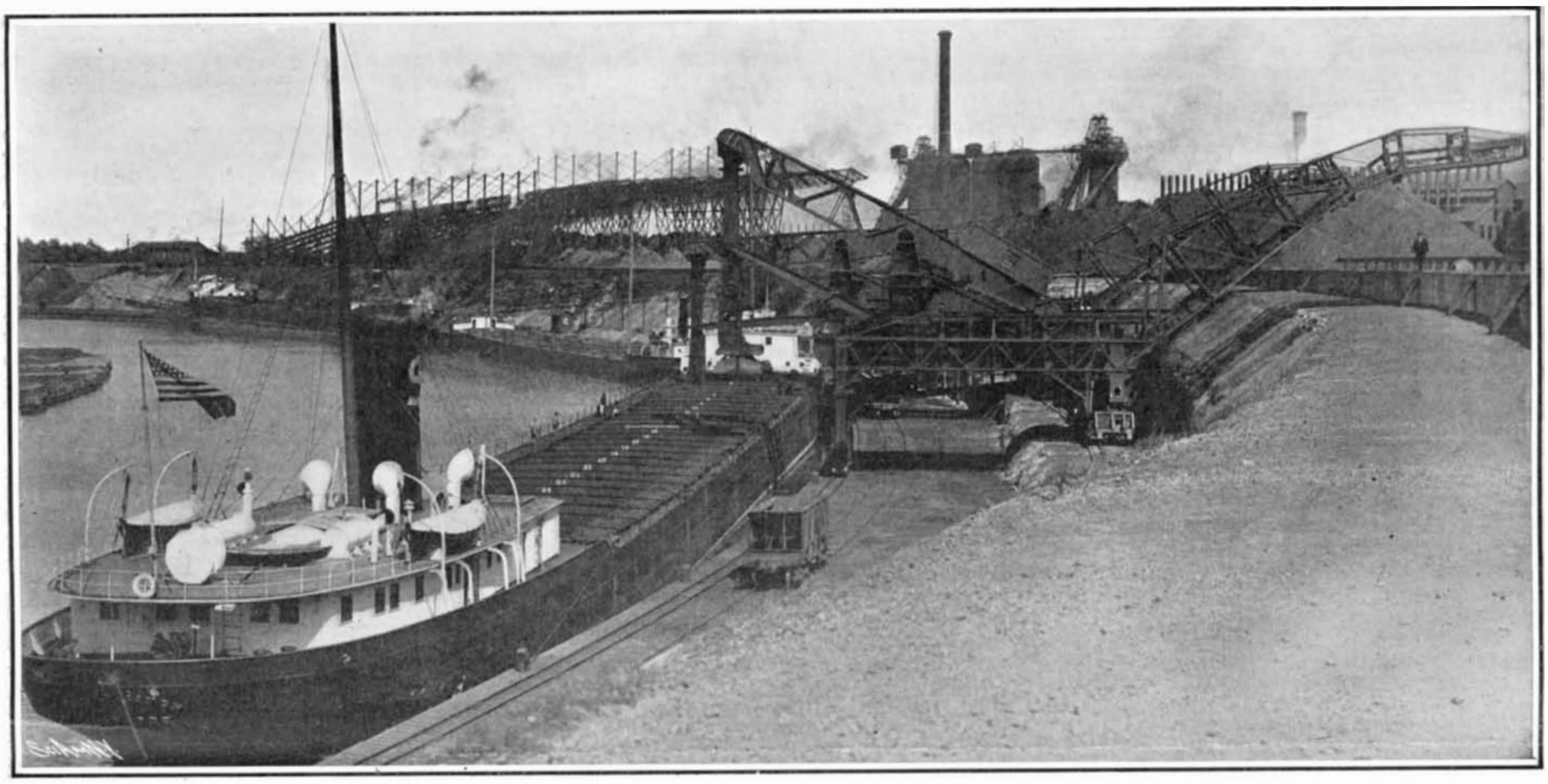
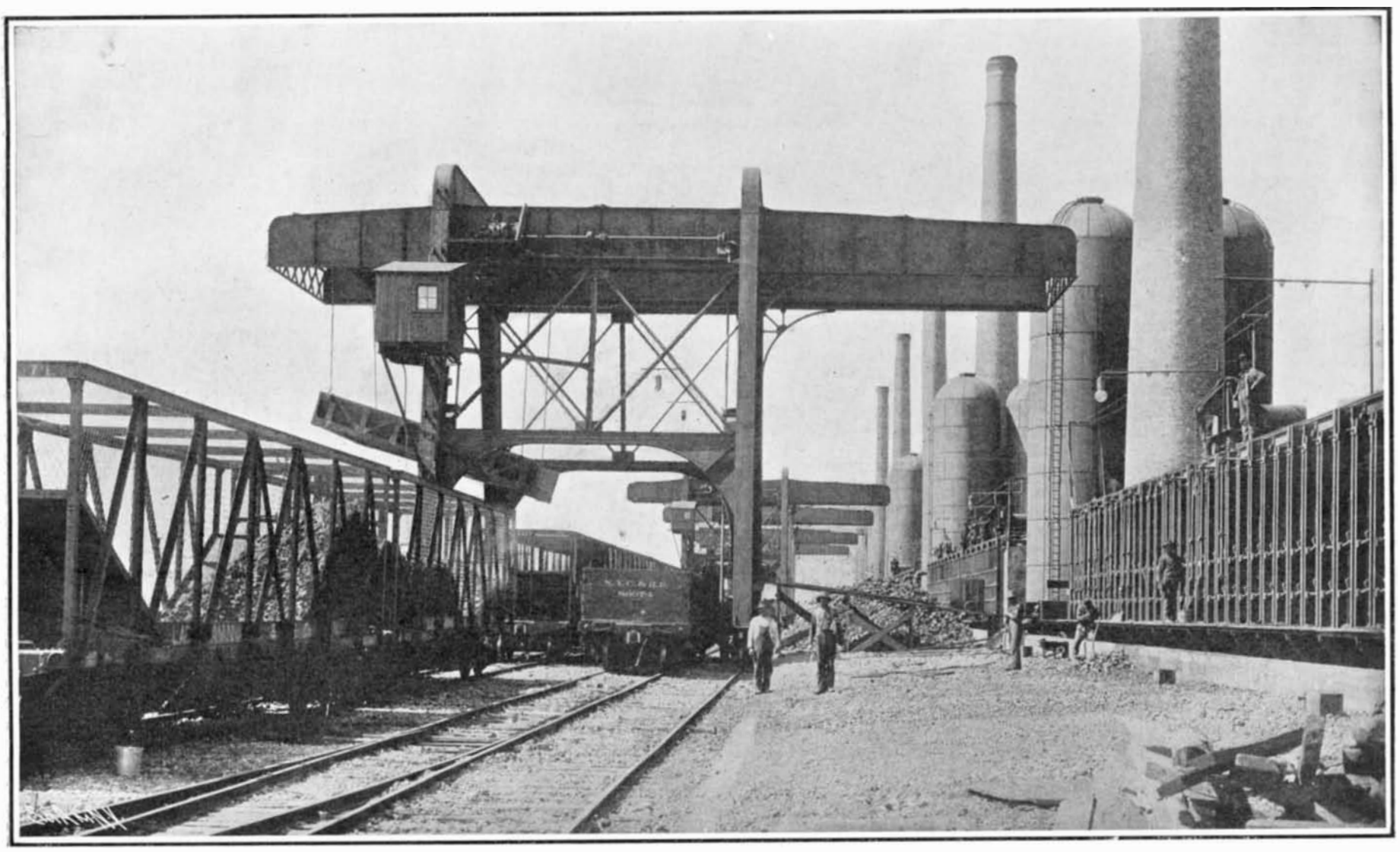
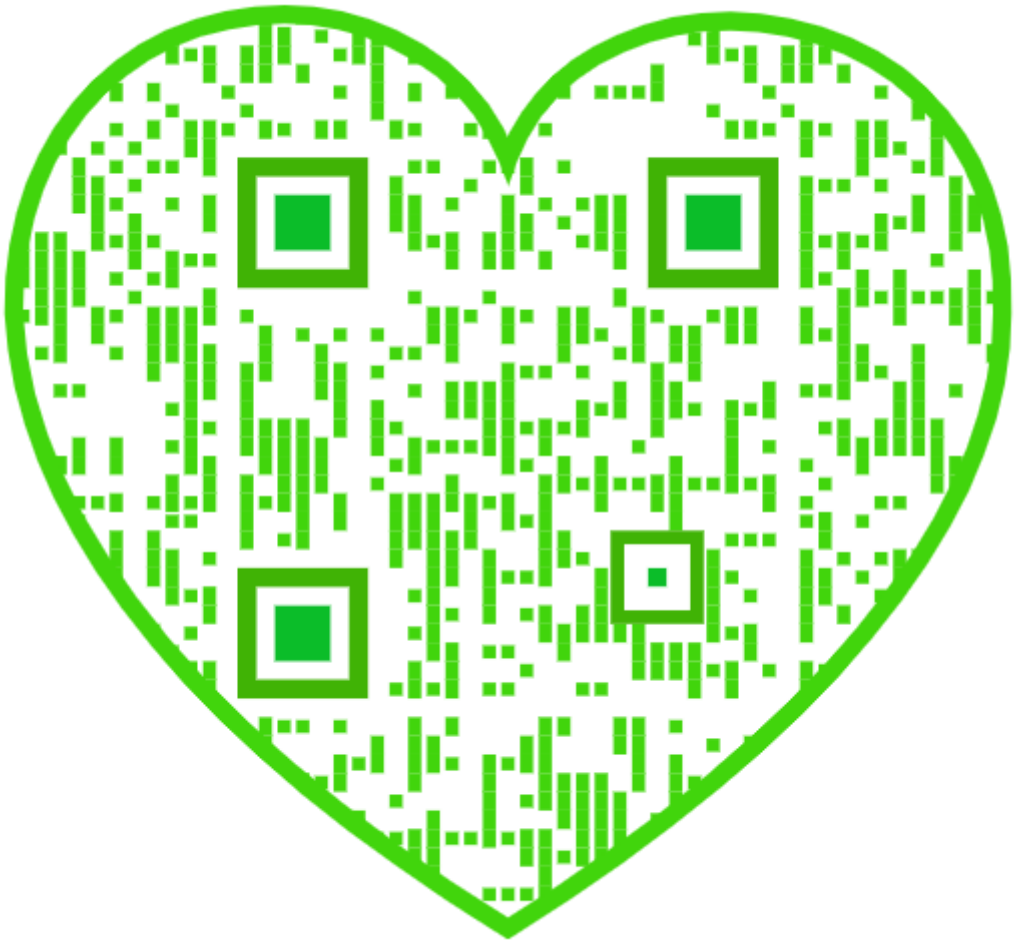


At the Ore-Unloading Docks of Conneaut, Ohio.



An Electrical Crane of Twenty Tons Capacity Which Handles Only Coke.

ORE-UNLOADING BY MACHINERY.—[See page 131.]



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NEW YORK, SATURDAY, FEBRUARY 10, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

STATE COMMISSION ON NEW YORK WATER SUPPLY.

According to its first annual report to the Legislature, the New York State Water Supply Commission has been occupied chiefly in considering the needs of New York city for an increased water supply. The application for permission to establish a water system in the Catskill region at a cost of $160,000,000 is the most important problem of its kind yet proposed in this country. The report says that, judging from the statement of eminent engineers, it seems altogether probable that New York city must eventually utilize the waters of the Hudson River, either directly from its source in the Adirondacks, or possibly at less cost near Poughkeepsie, at a point on the Hudson about 75 miles distant from the city. Attention is drawn to the movement for the purification and protection of streams and rivers, which has been carried out with such success in Europe, that it seems likely to have the ultimate beneficial result of abolishing the barbarous plan of making scavengers of fresh-water streams.

The plan for establishing a water system in the Catskill regions has provoked the inevitable opposition, which occurs when any inhabited, and more or less cultivated, watershed is appropriated for city water supply. The formation of the extensive reservoirs will mean the absolute flooding out of inhabited districts, and the removal of buildings and abolition of farms from a belt of land bordering on each side of the tributaries to the main reservoir. That the occupation of a watershed in this way works positive hardship upon the population cannot be disputed, although we understand that it is the sincere purpose of the Commission to make adequate compensation to the residents and owners who will be affected. To many of these, no doubt, the loss of their ancestral homes, and the wiping out of all the associations with which the locality is enriched, will mean a sentimental loss that monetary compensation cannot meet. The case thus becomes one of conflicting interests; and if, in the present instance, the Catskill watershed is the only one that can properly meet the pressing needs of New York city, stern necessity will compel the sacrifice of the minority to the imperative needs of New York city's many million inhabitants.

Although the Catskill scheme has been recommended as, all things considered, presenting the best solution of the problem, it is not by any means the only one that has been under discussion, or has received eminent professional indorsement. As the report of the State Commission suggests, New York city must ultimately be driven to the Hudson River as its main source of water supply. One Engineering Commission has suggested that the Hudson River water should be used in preference to that of the Catskills, either by bringing it direct from its sources in an aqueduct, or by building a pumping plant on the river, and raising the water to a system of filtering beds, located on the hills back of the river, whence it would flow by gravity to the reservoirs within the city limits.

In this connection we publish on another page a letter from a correspondent, who offers the very novel and striking proposal to impound the waters of the Hudson River in various reservoirs located near its sources; build at each site a hydraulic-electric plant; and transmit the current to an electrical pumping station at Poughkeepsie, where the Hudson River water would be raised to the filtration beds and reservoirs on the hills above. The scheme, if based on the Burr, Hering, Freeman estimate, would involve the raising of 500,000,000 gallons daily through a vertical height of 400 feet. Our correspondent believes that his project could be carried through with a saving of thirty per cent, as compared with the scheme of providing a dam at Ashokan and an aqueduct for conveying the water from the dam to a reservoir on the Poughkeepsie side of the river. As regards the project suggested by our correspondent, it must be remembered that for the performance of this work by the hydraulic-electric method, there must be provided, at the many power plants scattered through the Adirondacks, the energy represented by the fall of 500,000,000 gallons daily through a height of 400 feet, plus the power necessary to overcome the resistance in the pipe lines, in the turbines, in the generators, and in the step-up transformers. To this must be added the energy necessary to overcome the resistance in the hundreds of miles of transmission line between the Adirondack power stations and the pumping plant at Poughkeepsie, and also the resistance in the pumping plant itself due to the step-down transformers, the rotary converters, the motors, the pumps, and the pipe lines, from the intake at the Hudson to the outlet at the reservoir on the hills above. It would be an interesting problem, when the location of the power plants was established, to determine how many hundreds of millions of gallons must be delivered daily to the turbines, to cover the above-enumerated sources of loss, and still suffice for the stupendous and unending effort of lifting the 500,000,000 gallons daily to a height of 400 feet—this height being necessary to secure a flow to the high-level reservoirs within the city limit. The most sanguine estimate would demand, surely, that not less than 800,000,000 gallons daily should be available at the distant power plants. Yet we are informed by the Water Supply Department that a study of the flow of the Hudson in the driest seasons on record shows that it has fallen at Poughkeepsie as low as about 900,000,000 gallons per day. With all due recognition of the ingenuity of Mr. Parrott's proposal, we think that, if the Hudson water were used, considerations of security and permanence would lead to the selection of a steam pumping plant rather than one depending upon the variable flow of the upper Hudson.

THE DELAY OF THE MANHATTAN BRIDGE.

It will be within the memory of our readers that our last article on the Manhattan Bridge controversy was intended to close the discussion, as far as the columns of the SCIENTIFIC AMERICAN are concerned; but we have since received several letters from Mr. Hildenbrand, requesting us to re-open the subject to the extent of assuring the public that our criticism of his published letters was not intended to cast any doubt on his professional ability. We cheerfully comply, if only because of the opportunity it affords us to state, once and for all, the position of the SCIENTIFIC AMERICAN with reference to this matter. The point of view of this journal is that of the individual citizen, who, first and last, is the one that suffers from the inconvenience caused by the delay—the absolutely unnecessary delay as it seems to us—in the construction of this bridge. So long as the Manhattan Bridge be well designed and speedily built, the SCIENTIFIC AMERICAN cares not one iota what engineer writes his name at the bottom of the plans. Our strong advocacy of the design of the former Bridge Commissioner has been absolutely impersonal, and based entirely upon the merits of the case. The Editor formed a favorable impression, from the very first, of the plans for a chain-cable bridge—an impression which was deepened by the indorsement which these plans received from the Board of Engineers appointed by the Mayor to pass upon them.

That Mr. Hildenbrand's name appeared in the columns of the SCIENTIFIC AMERICAN was due entirely to his own act in sending us his letters for publication. We did not approve of his method of argument, and said so. We do not approve of it now. But he is quite in error if he thinks that our criticism was prompted by any motive of disparaging his professional ability. Mr. Hildenbrand may well be content to let his reputation stand upon the fact that he was mainly responsible (if we are not mistaken) for the design of the Brooklyn Bridge. His strong advocacy of the wire cable is consistent, and, we have no doubt, sincere; but in the present controversy we think that he has unwittingly allowed his zeal to get the better of his logic.

It seems to us that what is needed in a discussion of this matter is a broader point of view. Would it not be well for everyone concerned in the agitation that has already deprived New York city of this greatly-needed improvement for a period of nearly three years, to try to look at the question more from the standpoint of the good of the public, and less from the standpoint of personal predilection for any particular type of bridge. We seriously doubt if any of the engineers who opposed the design for a chain bridge believed that it would have failed, if built, to prove perfectly serviceable and safe. Even Mr. Hildenbrand, in his letter published in the SCIENTIFIC AMERICAN of November 4, 1905, says: "They" (the Board of Engineers that approved the rejected design) "were merely engaged for giving their opinion whether the design submitted to them was practical, whether the bridge, after being finished, would be fireproof, durable, and serviceable, and whether it would have sufficient capacity and strength. These questions were answered with 'Yes,' and if I had been a member of the committee, I would, with strict adherence to the same questions, have given the same verdict." Now, that the bridge would have been heavier than a wire bridge (with all that this involves) no one has ever disputed; yet, in their strong preference for the construction of a wire bridge, the Bridge Department, in spite of the delay which a change necessarily involved, threw aside the plans for a chain bridge, which Mr. Hildenbrand himself believes would have been, though heavier, "serviceable," and of "sufficient capacity and strength," and thereby subjected the city to the present intolerable delay, the extent of which no one can foretell. Herein lies the true burden of responsibility. The result of the agitation against the chain-bridge design has been to cause the city of New York enormous inconvenience, by delaying a most urgently-needed link in its system of transportation.

Mr. Hildenbrand claims that the responsibility for delay dates back to 1902, when the original design for a wire-cable bridge was thrown out. We believe, however, that the original design was both incomplete and inadequate to the increasing traffic, and that, whether a wire-cable or a chain-cable were used, new plans were in any case necessary. We may be wrong; but even if it be granted that the delay in 1902 was unnecessary, that is no justification for the further delay in 1904. Two blacks never yet made a white.

In the present dilemma the Merchants' Association of this city has made to the Mayor a recommendation which we cordially indorse. As matters now stand there are, in the Bridge Department, two complete sets of plans for the Manhattan Bridge. One of these, calling for a chain cable, has been passed upon and approved by a Board of Engineers; the other, which has never been offered for approval by an independent board, has been bid upon, but the bids have been thrown out by the courts. The Merchants' Association suggests that, as the Department is now in possession of two sets of plans, they should both be submitted to an independent board of engineers, and that fresh bids should be asked upon the plans which this board may approve. We sincerely hope that the Mayor will adopt a suggestion which is so sensible, and offers such a simple and quick way out of the present deadlock.

ON A TOUR OF THE SHOPS.

Shop methods have changed greatly in recent years, and school and college trained mechanics are making their influence felt more and more, but the old-time mechanic, with a mind accustomed to dealing with emergencies and able to turn his hand to almost anything, still survives in many of the shops. His training is very different from the younger generation. He knows less about mathematics and accurate drawing to scale, but his intimate knowledge of the practical working of machinery makes him an invaluable factor in every shop. He knows his machinery by heart, and any heart throb that is not natural attracts his attention. He can usually tell by the "feel" what ails a complaining machine. He knows every "cranky" engine or machine in the shop, and he understands how to favor each one to get the greatest amount of work out of it.

But it is in the repairing of machinery that the old-time shop hand is at his best. Here he is in his element. He was brought up in the school which made every machine shop an independent entity. It was impossible in those early days to order duplicates of machinery by telegraph, and expect them to be delivered within twenty-four hours. Consequently, every shop had its resourceful mechanics, who were capable of repairing any machine so that it could continue its work for several weeks until the new parts could be forged or made in some distant factory. It was this very training which made the old-time mechanics such men of inventive genius. If an engine rod broke or a steam box fractured, the mechanic of the shop could repair it so that work would not have to be shut down for long. The breaking of a huge flywheel only meant temporary delay. An old-time shop mechanic recently told me how he had rigged up a wooden flywheel within twenty-four hours after an iron one had broken, and the temporary one worked successfully until the order for a permanent wheel could be filled.

In the modern, up-to-date shop, where nearly every part of the machinery is supplied in duplicate, so that the breaking of any piece merely causes a little shut-down, the tendency has in recent years been to depend less and less upon the old-time all-round, ingenious shop mechanic. The feeling has grown that the human element will be more and more eliminated from the shop as an important skilled factor. It is the machinery which holds sway, and which does the work, and the man who operates it merely holds an inferior position. Yet there are some shops which take the opposite view of this. A visit to one of them a short time ago revealed quite a unique condition of affairs. It was filled with old-time mechanics and shop workers. Very few of the new school were present. Was this an accident or intentional?

"Partly both," replied the superintendent. "I brought most of these men back with me from Mexico, and I shall keep them as long as they care to stay

here. I went down there five years ago to install and run for a year a new railway shop in the city of Mexico. I knew I could not depend upon native labor, and so I selected my men in this country and took them with me. I was warned before I left that there was no possible way of getting duplicate parts of machinery in that part of the country inside of a month or two. It all had to be shipped by train from this country. Therefore it was quite essential that I should take with me men mentally equipped to tackle emergency jobs. I chose the old-time practical shop men, those who had been accustomed to the old methods of independent work. I was not disappointed. Down there we met some pretty ugly propositions in mechanics, for the railroad company was poorly equipped with repairing machinery. But we surmounted every difficulty. Every time we ran up against a hard thing, we held a council of war. Every man had a right to state his way of making the repairs, and then we selected from the list the most serviceable. Well, it would have surprised you to see some of the ingenious and practical methods proposed by those old mechanics. They could have given your new school-trained shop man a mile ahead start and beat him out. They gave me pointers which I haven't exhausted to-day. I shall continue working on them for years to come. When we got through with that Mexican job, I brought the men home, and I consider we have the best set of mechanics in any shop of the country. There is a feeling of responsibility among the men which is difficult to get in a mixed lot.

"We still hold our meetings to consider the best method of proceeding when anything happens, and the men put in their solutions for the trouble just as they did down in Mexico. At these meetings we get an exchange of views that is worth a good deal. For instance, the other day we found it necessary to make repairs to a warped bed on which some heavy machinery stood. The question was raised as to whether we should have a new bed on new foundations, repair the old, or design something of our own. Here is the proposition one of the oldest mechanics and engineers in the shop made: Tear up the old bed and foundation; cut down to hard pan in the soil in a space one foot wider than that required for the machine, and then build up a firm foundation of coarse stones laid in cement, and finish off the top with good concrete. This latter is brought up a few inches below the level for the bed. While the top course of concrete is soft, heavy three-inch oak plank is buried in it, the ends and sides being completely covered with the cement. When the cement hardens, the plank is firmly embedded. On top of this wooden bed fastened into the cement oak planks are screwed firmly, and to the wooden floor thus laid directly on and into the concrete foundations the legs of the machine are screwed. A perfectly level floor bed is thus obtained, and there is absolutely no vibration. When the floor gets warped or worn, the top planks can be taken up and new ones put down.

"This suggestion proved so novel and promising that we have made an experiment with it. We shall lay it under a heavy engine lathe, and if it proves all that is desired, we may repeat it under other machines. Like most shops, we have experienced a good deal of trouble with beds for heavy machinery. They get warped or uneven in a short time where the weight of the machinery is unevenly distributed, and particularly where the pounding of the machinery is over one part. The question of building absolutely firm beds which will neither warp nor drop on one end is a nice one in many shops. The constant raising of ends and putting chips under them to secure a perfect level can hardly be called good workmanship, and yet in many shops this is just what is being done. Beds which will not warp or change the level are greatly to be desired."

It is a fact that in a good many machine, repair, and construction shops, ideas and suggestions are made by the men which are not always received in the right spirit. The tendency to consider a poor mechanic of little account, except in his special line of work, is fatal to the highest efficiency of any single crew of men. Superintendents, foremen, and master mechanics are often so jealous of their own positions, that they resent any suggestions from those below them. Yet it has been the writer's fortune to run up against a number of cases where the most useful inventions in use in the shops came through the suggestions of the men who held inferior positions. They had the knack of seeing how things should be done to save time and labor, and their practical knowledge made their suggestions invaluable.

In a good many shops where devices of a novel nature are in use no drawings whatever exist, or if crude ones were made they have been destroyed. In many cases the men had the designs made according to the suggestions of subordinate mechanics. Frequently such crude devices have saved thousands of dollars to the shops, either through increasing the output or decreasing cost of production. As these devices are not patented they are not put on the market, and other shops are not benefited thereby. One shop is not inclined to throw open its secrets to another, but where devices are not considered important enough to patent, little harm can be done by an exchange of visits between master mechanics and foremen of shops. New descriptions of shop methods and labor-saving devices would furnish a great amount of data for shop foremen and superintendents to study, and in the aggregate they would greatly raise the general standard of appreciation of the subordinates who work in the various machine, repair, and construction shops of the country. A. S. ATKINSON.

PROPOSED DAM FOR LAKE ERIE.

BY ALTON D. ADAMS.

Niagara Falls may be given a more constant volume of water by the erection of a dam at the foot of Lake Erie. Such a dam would be of great benefit to the electric power plants about the Falls, and an important aid to commerce moving between the four upper lakes and the St. Lawrence River. These results would follow the erection of a dam at the outlet of Erie because that lake is subject to great fluctuations in level, while Niagara Gorge is only one-fifth to one-tenth as wide as the river above the Falls.

Of the four upper lakes, Erie is much the smallest in area, and its greatest depth is only 84 feet, while that of lakes Michigan and Huron is 1,000 feet, and that of Lake Superior 1,030 feet. Niagara River is the final outlet of the four upper lakes, but the great storage capacity of lakes Superior, Michigan, and Huron is not directly available to maintain its rate of discharge. This is due to the fact that Erie is lower than the three Great Lakes to the west, and connects with them only through the comparatively narrow and shallow channel of the St. Clair River. While the three higher and greater lakes thus supply much the larger part of the water that annually flows down the bed of the Niagara River, its hourly and daily rates of discharge depend mainly on the level of Lake Erie at its lower end. East and west along the length of Lake Erie the winds sweep a course of 290 miles, and pile up its waters at either end. The rise of water level due to wind action is particularly notable at the eastern end of Lake Erie, because it gradually narrows from its full width of 65 miles to the head of Niagara River, where the width is less than one-half mile. A strong wind from the west raises the water level at the foot of the lake, and largely increases the discharge rate of Niagara River, while an east wind has the contrary effect. By the action of wind alone the water level at the head of the Niagara River is varied as much as seven feet either way from the normal. Other causes produce a maximum change in Erie level of as much as four feet. When both the wind and other factors operate together it thus seems that the water level at the foot of Lake Erie may vary as much as nine feet from the normal. At the inlet of Niagara River the greatest depth of water is about twenty feet at normal lake level, and a change of seven feet, or about one-third of this depth, must obviously have a large effect on the rate of discharge. According to the report of the Secretary of War, a rise of Lake Erie level from 570.25 feet above mean low tide, in November, 1899, to 573.12 feet, in June, 1900, increased the discharge rate of Niagara River from 165,340 to 231,350 cubic feet per second. If this rise of 2.87 feet in the level of Lake Erie was followed by an increase of 40 per cent in the rate of Niagara discharge, how great must be the change in discharge rate that follows a variation of seven to nine feet in the lake level? In view of these figures, it is not hard to believe the story that the cliff which carries the American Falls was laid bare some years ago, after a strong east wind had been blowing for some days. The American Falls show the effect of low lake levels much more than do the Horseshoe, because the crest of the former is about seven feet higher than that of the latter. At Port Day, about one mile above the Falls, and where Niagara River is nearly a mile wide, records of the water level have been kept since 1886. In January, 1893, the river level at Port Day was down to 557.4 feet above mean low tide, and in January, 1899, the water level at the same point was up to 565 feet, a rise of 7.6 feet.

Such changes of the river level above the Falls work large variations in the heads of water on wheels in the power plants there, because Niagara Gorge is so much narrower than the river above. For each foot of rise in the river level above the Falls, the rise in the Gorge below is close to five feet. A rise of seven feet in the upper river thus brings about a rise of 35 feet in the Gorge, and the power plants at the Falls are exposed to a net change of as much as 28 feet in the heads on their turbine wheels. This change of head, besides directly affecting the available amount of power, makes the problem of speed regulation much more difficult.

These large changes of water elevation in the Gorge sometimes occur within very short periods. Thus, on November 2, 1897, the water level at the "Maid of the Mist" landing below the Falls was 334 feet above tide, but on November 6 the river surface had risen 27.7 feet, or to elevation 361.7, at the same point. Just above Goat Island, Niagara River is a mile wide. Between Prospect Point and the Canadian bank, below the Falls, the width is no more than 1,000 feet, and after the railway bridges are reached there is a stretch along the Whirlpool Rapids where the width is only 400 feet. The channel in the Gorge for a mile below the Falls is thus no more than one-fifth as wide as the river above Goat Island, and this goes far to account for the fact that changes of water level are five times as great below as they are above the Falls. Navigation by way of the Welland or the Erie Canal is much interfered with by changes of 7 to 9 feet in the water level at the eastern end of the lake, because the regular depth of the former canal is but 14, and of the latter 7 feet. A dam at the head of Niagara River would prevent an excessive discharge of water when the level was exceptionally high at the eastern end of the lake, and would maintain the water surface at a more nearly constant elevation. With no dam at the outlet of Erie, high water there produces an abnormal rate of discharge, much greater than the inflow from the St. Clair River. The consequence is that when the temporary high water at the foot of the lake subsides, its entire level sinks below the normal until the discharge from Lake Huron brings it up. To dam Lake Erie presents no great difficulties from an engineering point of view, apart from the mere magnitude of the work. For a length of one-half mile just below the outlet of Lake Erie, Niagara River is no more than three-eighths of a mile wide between Buffalo and Fort Erie, Ontario, and its greatest depth of water is about 20 feet. A low dam at this point would accomplish the purposes named above.

PRIZE FOR ELECTRIC DEVICE.

A prize contest has been organized by the Hydraulic Power Syndicate of Grenoble, France, relating to a much-needed device for use in electric light or power stations. On the system of wiring which distributes current to the subscribers, each of the branch circuits is established so as to provide for a certain power whose maximum is determined in advance, and the arrangement is made with the subscriber either by contract or meter. It often happens that the maximum of current is exceeded for more or less time, and this causes trouble upon the whole system which the station supplies. It will be of value to have a method which will allow of notifying the subscriber in the first place, and if he pays no attention, of obliging him to return to the conditions of his contract, this without annoying surveillance on the part of the central station. The proposed current-limiting device is to work at a higher power than 5,000 watts and on all kinds of current. It is to give a signal as long as possible before it commences to operate; then it limits automatically the current on the branch line, working every time the proper current is exceeded. It can be set back again, but leaves each time an indication of the resetting. A complete description is to be sent before April 1, 1906, to the Siège Social du Syndicat des Forces Hydrauliques, 63 Boulevard Haussmann, Paris, also (if accepted) two apparatus, which are to be tested on the line and in the laboratory. A prize of 2,000 francs ($500) is to be awarded for the best device.

OFFICIAL METEOROLOGICAL SUMMARY, NEW YORK, N. Y., JANUARY, 1906.

Atmospheric pressure: Mean, 30.13; highest, 30.72; lowest, 29.25. Temperature: Highest, 63; date, 29th; lowest, 13; date 10th; mean of warmest day, 54; date, 23d; coldest day, 20; date, 9th; mean of maximum for the month, 42.8; mean of minimum, 31.8; absolute mean, 37.3; normal, 30.4; average daily excess compared with mean of 36 years, +6.9. Warmest mean temperature for January, 40, in 1880 and 1890; coldest mean, 23, in 1893. Absolute maximum and minimum for this month for 36 years, 67, and —6. Precipitation: 2.98; greatest in 24 hours, 1.63; date, 3d and 4th; average for this month for 36 years, 3.78; deficiency, —0.80; greatest precipitation 6.15, in 1882; least, 1.15, in 1871. Snow: 3.0. Wind: Prevailing direction, west; total movement, 10,451 miles; average hourly velocity, 14.0 miles; maximum velocity, 61 miles per hour. Weather: Clear days, 8; partly cloudy, 9; cloudy, 14. Sleet, 13th, 14th, 20th; fog, 4th, 12th, 16th, 21st, 22d, 31st. Thunder storms, 4th.

Hydrodynamics, elasticity, optics, electricity and magnetism, though originally based on molecular hypotheses and the idea of central forces, in the course of their development found themselves more or less independent of these notions. In all of them the important common feature is the propagation of actions through a medium which can be regarded, at least in first approximation, as continuous. In hydrodynamics and in the theory of elasticity this medium is that unknown something which we call matter; in optics, and later in the theory of electricity and magnetism, it was found necessary to postulate the existence of another medium, the ether.

AN AMERICAN MODIFICATION OF THE PARSONS STEAM TURBINE.

The steam turbine recently installed by the Allis-Chalmers Company at Utica, N. Y., for the Utica Gas and Electric Company, has aroused a great deal of interest. The turbine is rated at 1,500 kilowatts normal load, and is direct-coupled to a two-phase, sixty-cycle, revolving field alternator, which it drives at a speed of 1,800 revolutions per minute. The interest in the new turbine is due not to any new principle of operation, for in this respect it closely follows the Parsons type, but rather to certain constructional features which mark a distinct advance in turbine building. The improvements relate particularly to the manner of assembling the blades and securing them to the cylinder and spindle, also to the novel method of reinforcing and protecting the tips of the blades.

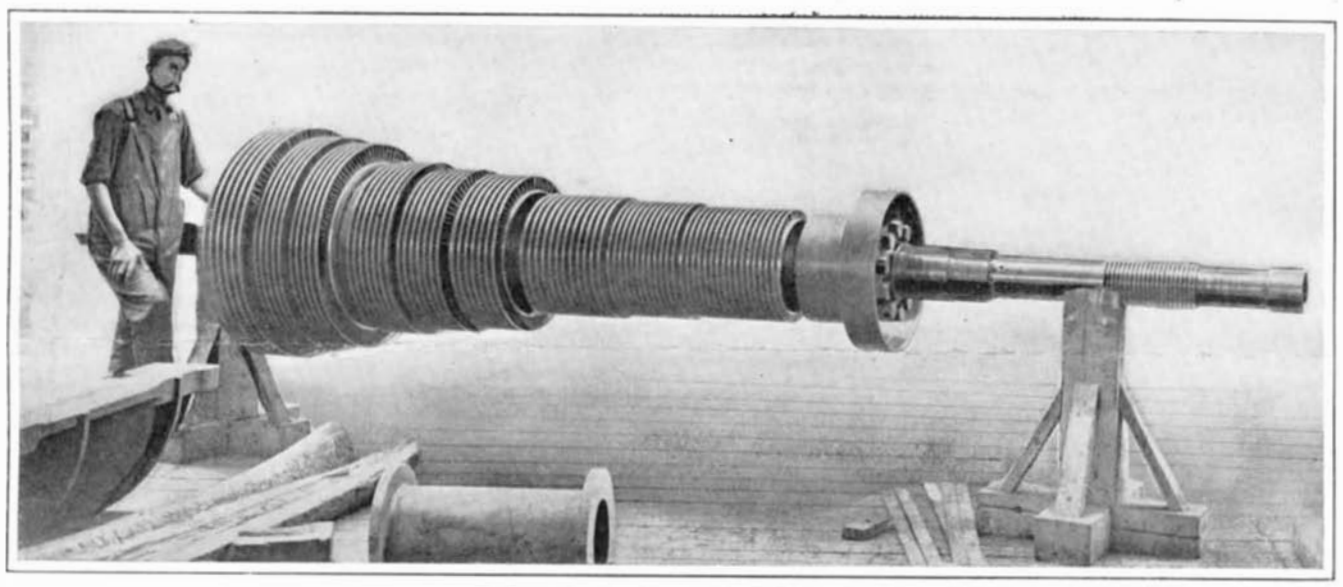
One of our illustrations is a section taken through a portion of the cylinder and spindle showing the blading construction. The blades are formed with dovetailed roots, which are fitted into slots cut in base rings. These rings are also of dovetail shape in cross-section, and are inserted in dovetailed slots cut in the cylinder and spindle respectively, and are secured by key rings in the manner of a lewis bolt. To hold the key rings in place, the slots are undercut, and after the key rings have been driven into position, they are upset into the undercut grooves. The tips of the blades are reinforced by shroud rings of channel form. The blades are secured to these rings by means of shouldered projections, which are inserted in slots in the rings and riveted over. The slots are uniformly spaced and formed at an angle to position the blades at the proper working pitch. All of these operations are performed by machinery, insuring an absolute uniformity of blading. The shroud rings, aside from bracing the ends of the blades and preventing any individual blade from working loose, serve also to prevent stripping of the blades in case of contact between rotating and stationary parts. This has been one of the chief difficulties encountered in previous constructions, a difficulty which inventors have long been striving to overcome. The use of shroud rings also permits a much smaller working clearance, reducing loss by leakage of steam past the ends of the blades, a loss which has been very serious in previous constructions.

The blading is assembled in half rings, and carefully tested before being set in position in the turbine. The outwardly-projecting flanges are then turned and bored to provide the necessary working clearance. Owing to their channel form, the shroud rings afford ample stiffness to the construction. Yet the flanges are quite thin, so that if for any reason one of the moving shroud rings on the spindle should come into contact with the stationary cylinder, or if one of the stationary rings on the cylinder should accidentally touch the moving spindle, the friction would not develop a dangerous degree of heat.

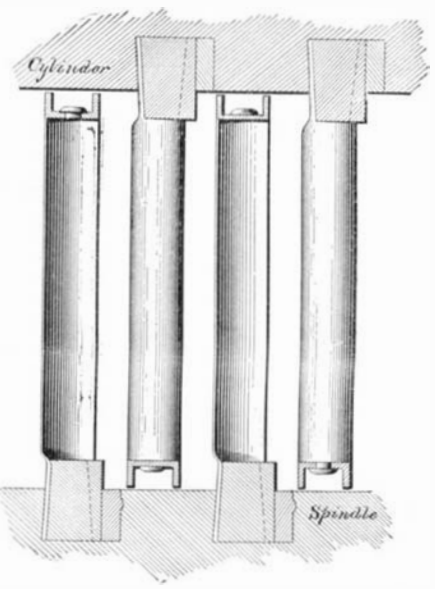
The criticism of this method of blading has been made that the blades are weakened at the root, owing to the dovetail formation. In answer to this, it is claimed that while the cross-sectional area at this point is slightly less than the normal section of the blade, yet owing to its shape the blade is really stronger at the root to resist cross breakage than elsewhere. An accident recently occurred at the West Allis shops which served to show the strength of the turbine blading. A turbine spindle with blades assembled was put into a lathe for the purpose of turning off the shroud rings to give the necessary working clearance, as well as to smooth up the key rings which hold the blading in the dovetail grooves. The workman who was running the tool down between two rows of blades accidentally moved the tool rest too far, so that the back of the tool ran into one of the rows of blades. As a result the blades simply bent over as far as the lathe tool could push them, and the channel shroud ring was distorted by reason of its fastening to the blades, but not a single blade pulled out or broke off at the root, and not a single blade pulled out of the shroud ring or even broke off at that point, where the cross section is less than one-third of the cross section of the root. It was necessary to cut away the shroud ring with a hack-saw before the blades could be removed for the purpose of inserting new ones.

A Portion of the Spindle, Showing the Blading.

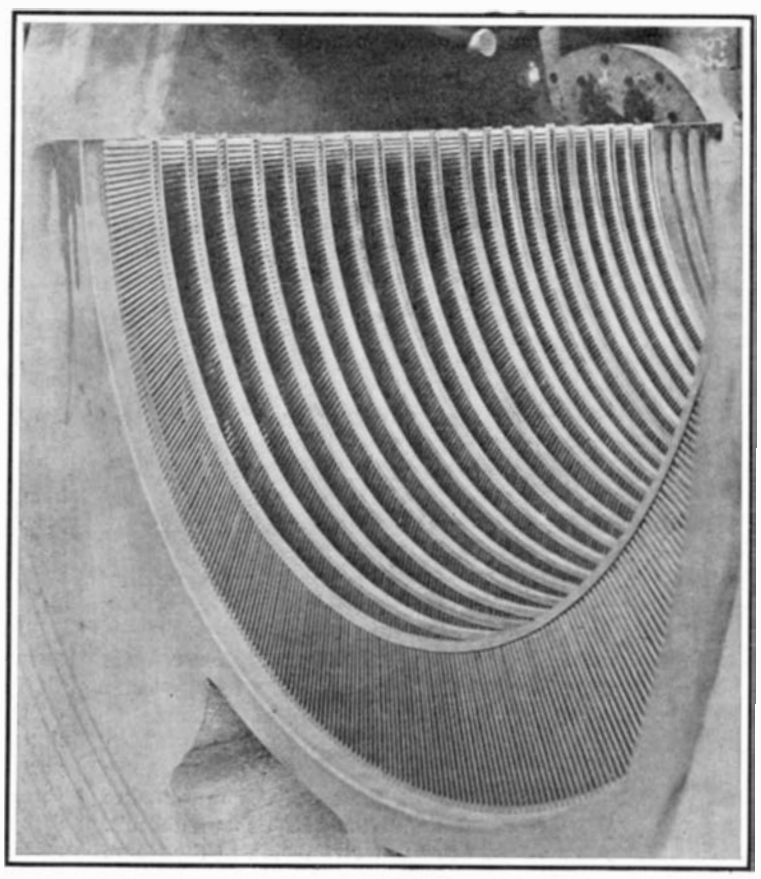
Another feature of this turbine which is likely to arrest attention is the fact that only two balancing pistons are shown. These may be seen at the high-pressure end of the spindle. In previous constructions of this type three pistons are used. As a matter of fact, there are three pistons in the present construction, the third one being applied at the low-pressure end, and being concealed in our photograph behind the large end of the spindle. The advantage of applying the piston at this point is that it relieves the shaft of undue tension, for it will be evident that the greatest axial pressure on the spindle is exerted at the low-pressure end. The piston can also be made smaller than in previous constructions. Instead of using "dummy packing" on these pistons, a packing of radial baffling type has been adopted. That is, the peripheries of the pistons are grooved, and fit into grooved bearings in the cylinder casing. In this manner small axial clearance in the turbine is eliminated.



The Spindle of the Allis-Chalmers Turbine.



Section Showing the Blading Construction.



Lower Half of the Cylinder, Showing the Blading.

AN AMERICAN MODIFICATION OF THE PARSONS STEAM TURBINE.

Rubber from Bark.

The new processes of extracting rubber from the bark of the plant are attracting some attention. In France, Henri Jumelle succeeded in producing rubber and gutta percha from the plant known as *Mascarenhasia longifolia*. Different methods are used, among which he employs the Deiss process. This consists in grinding up the bark and pounding it in a mortar, leaving it for seven days in half a gallon of sulphuric acid for one pound of bark. The black mass which is formed is washed, and the separation of the rubber from the disaggregated bark is carried out in a roller machine having wood rollers between which passes a stream of hot water. A better method is to pound up the acid paste so as to obtain the rubber more quickly, washing the paste then in a continuous stream of cold water. The rubber which is set free is pressed together in the roller machine and left in the air for twenty-four hours. In this way we obtain 6.20 grammes (about 100 grains) of rubber per pound of bark. Another process consists of grinding and pounding up the dry bark, and the powder which falls at first from the sieve does not contain any rubber. What remains on the sieve is again beaten up and agglutinated in hot water. The paste is triturated by hand and at the end of four hours the rubber is separated. Its color is lighter than the above. The Hamet process consists in leaving the crushed bark for two hours in a tight boiler in a 15 per cent soda solution at 130 deg. C. A black paste is formed which is well agglutinated and the rubber separates out in a few minutes by washing in cold water. It is a grayish-brown, but blackens upon drying. It appears that by the above processes we can obtain some 4 or 5 per cent of commercial rubber from the bark of the plant.

It is not practicable to prevent the smoke evil entirely, but only to mitigate it in a degree. Smoke burning, on the other hand, is an impossibility under the conditions which usually present themselves.

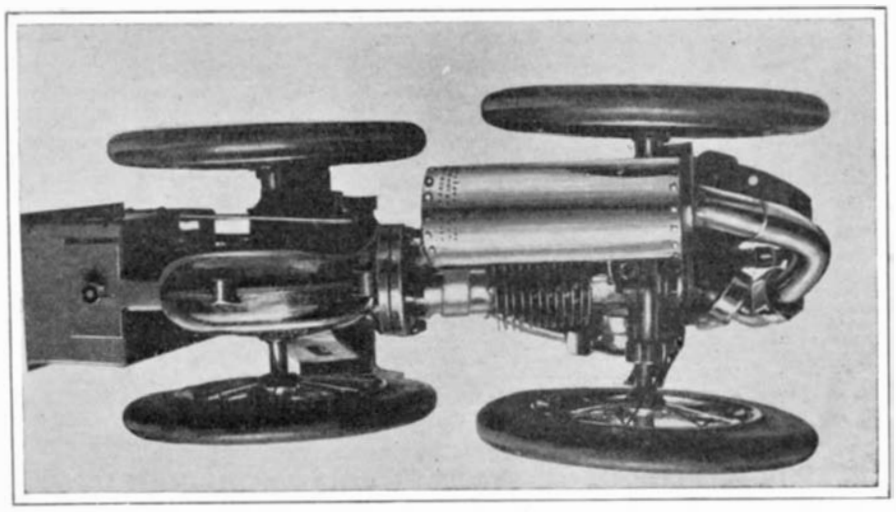
THE MOTOR SKATE—A NEW THOUSAND-LEAGUE BOOT.

BY OUR PARIS CORRESPONDENT.

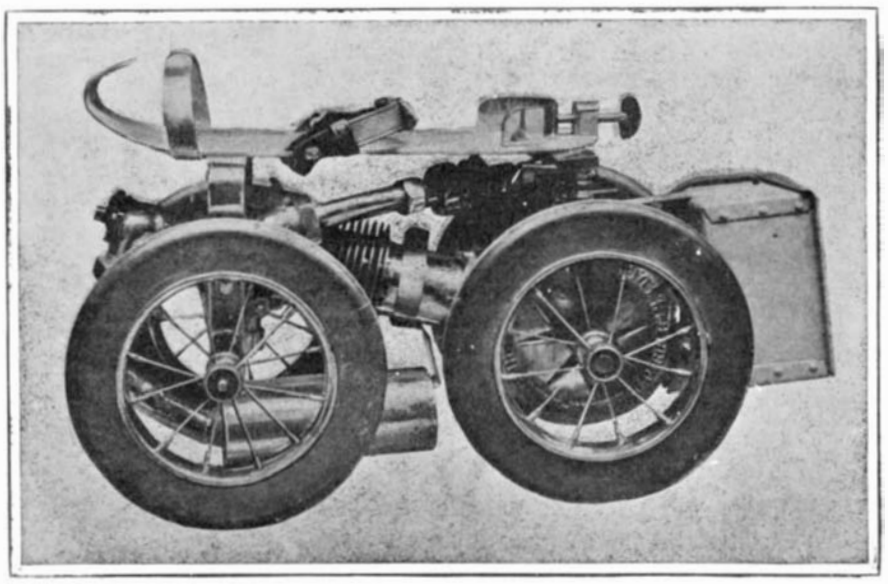
A novel device in the way of an automobile skate driven by a small gasoline motor is the invention of M. Constantini, a well-known constructor of Paris. The new skate consists of a foot-plate which is mounted upon four rubber-tired wheels, while the motor occupies the middle space. Thus the apparatus can be adapted to the foot just as an ordinary roller-skate, the only difference being that the wheels are of a considerably larger diameter. The little device is found to work very well and a person soon learns how to run it. There is no doubt that it will offer a new means of recreation to lovers of sport. It has already attracted considerable attention in Paris, where it has but lately made its appearance. The device consists of two separate parts, first the pair of skates proper, and also the belt worn by the operator and containing a small, flat, gasoline tank. The latter is connected with the carbureter on each skate by a rubber tube which can be readily detached, and near the tank are the valves for controlling the gasoline feed. At first M. Constantini designed the apparatus so as to carry on the belt a small storage battery and spark-coil for the purpose of ignition, and both these are made in a specially small form. But in the most recent type he places both battery and spark-coil in a small metal box with sliding cover, which is fitted upon the back part of the skate against the motor case. The box adds but very little to the size or weight of the skate and lessens the number of connections between it and the belt, so that at present these are reduced to the two tubes for the gasoline.

We give two views of the device, one a side view and the other showing the under side of the skate. The foot-plate is of light and strong steel and is hinged in the middle for steering. Each skate carries a small air-cooled gasoline motor of the usual 4-cycle type such as is used at present on motor bicycles, and it is designed so as to occupy a very small space. Fixed on the motor is a small carbureter; and under the front of the motor, which is mounted in an inclined position, is the cylindrical muffler which a curved pipe connects with the top of the motor cylinder. In the bottom view the muffler has been shifted to one side so as to show the motor. The rear driving wheels of the skate are mounted direct upon the motor crank shaft and thus the motor itself is made to serve as the main support and frame of the skate. The steering wheels in front are mounted on a loose axle which turns about a central pin, and the latter is fixed in a bracket plate which is screwed to the motor cylinder. The wheels carry solid rubber tires which have a somewhat narrow tread combined with a good radial thickness, as this is found to be the best practice. The motor and all the metal parts are nickel-plated, and the skate has as a whole, a neat appearance.

Steering is carried out by working the front part of the plate by the foot. The foot-plate is mounted upon elliptical springs in the front and rear. The foot is held by an adjustable heel-plate which is worked by a screw. A flexible cable connects with the ignition-shifting mechanism and is operated by a handle on the belt. The current can be cut off by a switch.



Under Side of Skate, Showing Battery Box and Motor Crankcase at Left and Flanged Cylinder and Muffler at the Right.



Side View of Skate, Showing the Foot Plate Mounted Above the Motor, Which is Inclined Slightly and the Crankshaft of Which Forms the Rear Axle. The Front Axle Turns for Steering.

MOTOR SKATES, THE LATEST PARISIAN NOVELTY.

The operator puts on the belt and connects the gasoline tube and ignition cable to the skate. He then switches on the current and opens the gasoline feed, pushing the skate with the foot, so as to start the motor. He slows up when desired by shifting the ignition, cutting the current, or lifting the rear wheels from the ground. The skate can be used on a floor or smooth ground, and even upon a good piece of smooth road. A speed of 15 or 20 miles an hour is said to be attainable with it.

THE HELICOPTERE: SANTOS-DUMONT'S LATEST FLYING MACHINE.

BY L. RAMAKERS.

Santos-Dumont has constructed a "flying machine" with which he expects to win the Deutsch-Archdeacon $10,000 prize for machines "heavier than the air."

According to information furnished by the inventor, this new machine is to be a hélicoptère, or "screw-flyer," that is to say, an apparatus which will raise, support, and propel itself through the air solely by the power of horizontal and vertical propellers.

For the practical realization of this idea, it is necessary to combine minimum weight with maximum power, and therefore the new apparatus has been designed to develop great power with the lightest possible materials. The frame and the rigging, like those of the dirigible balloons of the same inventor, are made entirely of bamboo, silk, and piano wire; and only the motor and the mechanism for the transmission of power are formed, necessarily, of heavier metal parts.

M. Santos-Dumont has succeeded in performing the almost incredible feat of constructing lifting propellers of a diameter of 6 meters (19.68 feet) and a weight of only 9 kilogrammes (19.84 pounds). Although these propellers are made entirely of silk and bamboo, each developed and withstood a tractive effort of 90 kilogrammes (198.41 pounds) when driven at a speed of from 90 to 100 R. P. M. by a 9-horse-power motor. From this result M. Santos-Dumont infers that the same propellers driven by an 18-horse-power motor will sustain a weight of 180 kilogrammes (396.82 pounds). His entire apparatus, however, will weigh only 160 kilogrammes (352¾ pounds) and it will be furnished with a 24-horse-power air-cooled motor weighing 35 kilogrammes (77.16 pounds), or about 3¼ pounds to the horse-power.

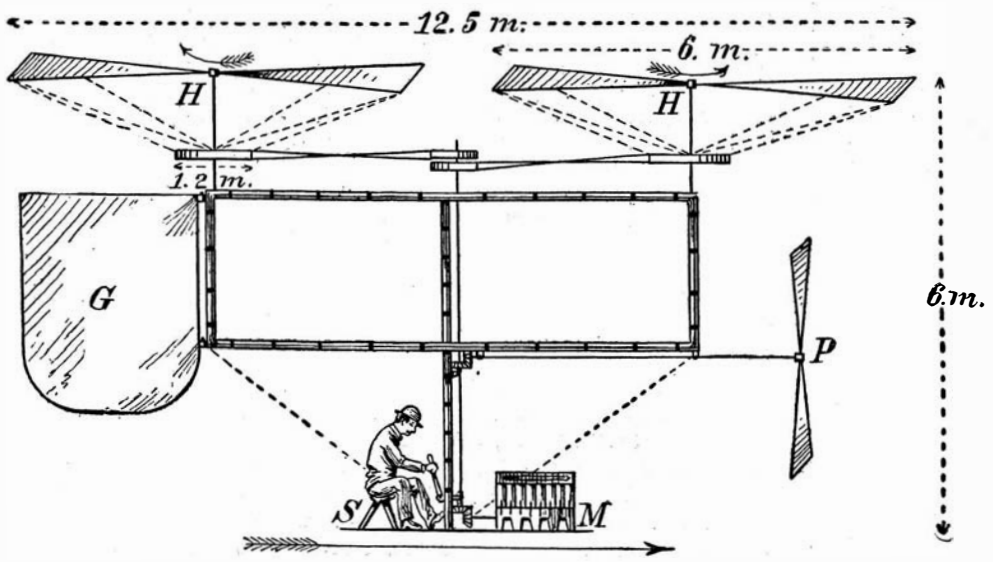
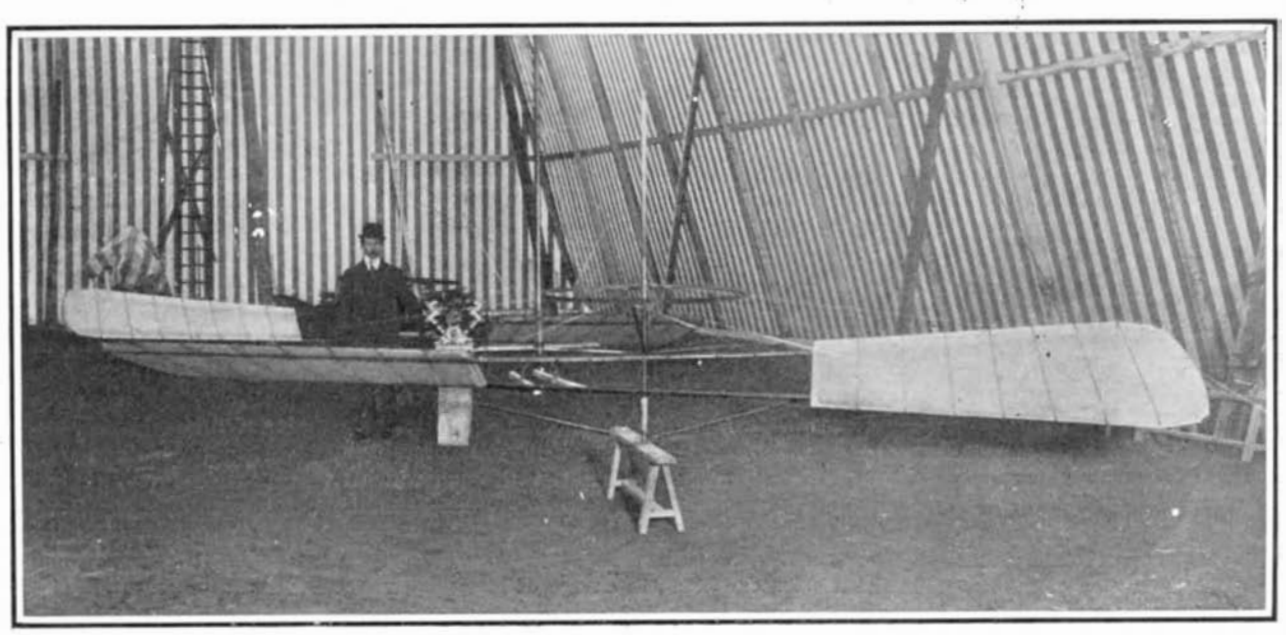


Diagram of Santos-Dumont's Proposed "Helicoptere."

H, H. Lifting propellers. P. Driving propeller. G. Rudder. M. Motor. S. Aeronaut's seat.

As may be seen from the accompanying diagram, the hélicoptère is formed of a rectangular frame of bamboo, which carries at its ends the vertical shafts of the upper or lifting propellers, *H H*. In the middle of the frame is a third vertical axis which, prolonged downward, serves as a support for the motor platform. A driving propeller, *P*, is attached to the bow of the skeleton craft, and a rudder, *G*, to the stern. The total length of the apparatus is 12.5 meters (41 feet), the total height 6 meters (19.68 feet).

The motor, *M*, drives (by bevel gears) a vertical shaft carrying at its upper end two small pulleys which transmit the motion, by belts, to two bicycle wheels, 1.20 meters (3.93 feet) in diameter, mounted horizontally on the shafts of the lifting propellers. One of the belts is



SANTOS-DUMONT'S "HELICOPTERE" IN COURSE OF CONSTRUCTION.

straight, and the other is crossed, so that the two propellers rotate in opposite directions. A bevel pinion, which can be thrown in and out of gear, permits the horizontal shaft of the driving propeller to be started and stopped at will. Finally, the whole apparatus is stiffened by shrouds of piano wire so arranged as to resist deformation stresses. A yard, attached at right angles to the lower side of the frame and fastened firmly by stays to the other pieces, assures transverse stability.

Two details are of sufficient importance to deserve special mention. In the first place, in order to prevent deformation of the lifting propellers and to make possible their extraordinary lightness of construction, M. Santos-Dumont drives them, not by the motion of the shaft on which they are mounted, but by means of wires (visible in the diagram) which connect various points of their blades to the bicycle wheels to which the power of the motor is transmitted. In the second place, the rudder, *G*, presents the peculiarity of being movable about a horizontal axis.

I may add that the motor (constructed by the Levavasseur firm of Paris) is of the eight-cylinder type, and that M. Santos-Dumont, in order to reduce the weight of the machine to a minimum, will employ for the operator's seat an ordinary bicycle saddle attached to the platform of the motor.

The complete apparatus, manned and equipped, weighs 160 kilogrammes (352¾ pounds), of which 105 kilogrammes (231½ pounds) represent the weight of the hélicoptère and 55 kilogrammes (121¼ pounds) that of the aeronaut and a few indispensable instruments.

These figures show how far M. Santos-Dumont has gone in eliminating everything that appears to him superfluous. With a lifting power of 10 kilogrammes (22 pounds) per horse-power, the 18 horse-power which the inventor expects to develop at the propellers should produce an ascensional force of 180 kilogrammes (396 pounds), or 20 kilogrammes (44 pounds) more than the total weight of machine and operator.

The Dufaux brothers, who have experimented considerably along these lines, claim, however, that it is impossible to construct a machine within the weight given. They point out that when one deducts the weight of the motor (35 kilogrammes), the large horizontal propellers (18 kilogrammes), and Santos-Dumont (54 kilogrammes) from the total stated weight (160 kilogrammes), only 53 kilogrammes (116.84 pounds) remain for the entire framework of the machine, the vertical propeller, four bevel gears, two pulleys, two bicycle wheels, two belts, and two strong power-transmitting shafts. This, they maintain, is entirely too light a weight for all this material. Granting that the main propellers weigh only 18 kilogrammes and the motor 35, they consider that the frame and its steel wire braces will weigh fully 50 kilogrammes, the transmission shafts, gears, belts, bicycle wheels, etc., 40 kilogrammes, and the motor accessories, such as spark coil, batteries, gasoline tank, and the like, 15 kilogrammes, thus making a total weight of 212 kilogrammes, or, exclusive of the motor, 32 kilogrammes more than the propellers will be able to lift with 18 horse-power to drive them. But, according to the Messrs. Dufaux, the probabilities are that fully 9 of the total horse-power developed by the motor will be lost in transmission, which would leave only 15 horse-power, or 150 kilogrammes lift, available at the screws. This would bring the deficiency in lifting power as high as 62 kilogrammes (136.68 pounds). Besides this, no account seems to have been taken of the loss from the air resistance of the entire apparatus, and especially of the vertical propeller. Furthermore, some power must be reserved to work this propeller. In the calculation given this has not been done.

Another point which the Messrs. Dufaux bring out is that once the apparatus was in the air and the vertical propeller was set going, the machine would have a tendency to tip up, and that then the two forces would counteract one another, with the result that it would not move ahead at all, or, if it did so, this forward movement would be accomplished with uncertainty and under extreme conditions of inefficiency.

The Dufaux brothers express the opinion that Santos-Dumont is wasting his efforts and that he might better apply them to the aeroplane solution of the problem in view of the "present state of the science and the actual deplorable inefficiency of sustaining propellers." They recall the fact that nine years ago the "Avion" propeller machine of M. Ader rose from the ground by its own power, and that there have been several other attempts besides their own in this direction. The Dufaux brothers' apparatus was described in our issue of October 21 last, and still other experiments with horizontal propellers were illustrated in the Scientific American of December 9, 1905.

As to the danger of falling due to the possible stoppages of the motor, M. Santos-Dumont claims that there is nothing to fear, because the motion of the propellers would not be arrested instantaneously and they would consequently retard the fall in the manner of a parachute.

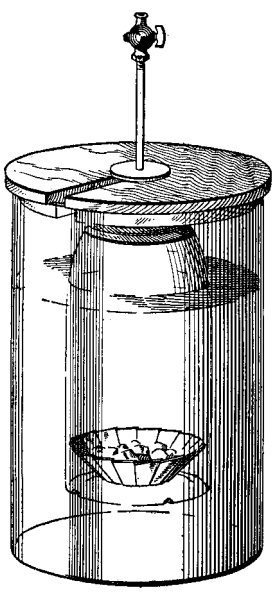
A CONVENIENT HYDROGEN GENERATOR.

BY H. B. DAILEY.

A hydrogen generator of simple and durable construction is herewith illustrated.

The apparatus will be found highly convenient for a variety of experimental uses requiring an ever-ready supply of hydrogen in small quantities. Among its particularly obvious utilities might be mentioned its use in electrostatic experimentation, for furnishing gas for exhibiting the chemical union of oxygen and hydrogen in the gas-gun or "Volta's pistol," for filling Geissler tubes before exhaustion, etc.

Beneath a flanged, radially-slotted wooden cover, resting on the rim of a 6-inch by 8-inch glass or earthen jar, is suspended a quart size glass fruit can. The suspension is effected by means of a short brass tube soldered into a central aperture in the zinc screw cover of the can, the latter being held snugly up against the wooden cover by a centrally-drilled disk of sheet brass soldered on the tube just above the wooden cover. In the bottom of the inner jar, close to the outer edge, are four openings made by filing across the corner of the can with a sharp coarse square file, kept wet with turpentine. These openings must not extend any distance up the sides of the jar; hence, the file should be held at a rather small angle with the bottom. When the square file has made a small opening, the hole should be enlarged to about 5-16 inch diameter with a small, sharp rat-tail file, wet with turpentine, the enlarging to be done in the bottom wall of the jar. Within the inner jar is a copper tray or pan with a perforated bottom, containing some lumps of cast zinc or some sheet zinc clippings. The pan is formed from a four-inch disk of sheet copper cut radially from a number of points around its circumference to within an inch of the center. The flaps or leaves thus formed are bent vertically upward until the copper will pass through the top of the leaves are can; the outwardagain then sprung the jar. The until they fill tains dilute outer jar con- acid, whose sulphuric should not surface the zinc top quite reach jar when the of the inner ty of fluid. latter is emp- the stopcock On opening ment, the acid for a mo- ner chamber, enters the in- the zinc and submerging the cock may copper, when The presence be closed. in contact of the copper greatly has- with the zinc lution of the tens the evo- through gal- hydrogen The expand- vanic action, ing gas expels the acid from the inner cham- ber, protect- ing the zinc from further action, and leaving the chamber full of hydrogen under mild hydrostatic pressure. When the stopcock is opened, the escaping gas allows the acid to re-enter the inner chamber, and the generation begins anew. Before screwing on the zinc cap, its inner surface should be well smeared with tallow, to protect it from the acid-laden spray from the interior. Both sides of the rubber gasket under the rim of the cover should also be greased, to insure an air-tight joint. The slot in the wooden cover allows the removal of the fruit jar for renewal of the zinc. A sufficiency of leaden weight is attached to the under side of the wooden cover, to resist the floating tendency of the inner jar when empty. With the stopcock closed the apparatus can remain inactive indefinitely, always containing a supply of hydrogen ready for use.



A CONVENIENT HYDROGEN GENERATOR.

Simplon Tunnel Open to Traffic.

The first passenger train, carrying notabilities and officials, passed through the Simplon tunnel on January 25, 1906, amid artillery salutes.

Undertaken jointly by the Italian and Swiss governments in 1898, the Simplon tunnel was completed at a cost of more than $15,000,000. It is twelve miles long, extending from Brigue, Switzerland, to Isella, Italy.

Difficulties that at times seemed insuperable were met by the engineers. In September, 1904, came the most serious trouble; springs of hot water were encountered and the tunnel was flooded. The temperature rose to 131 deg. F. Earlier still the laborers from the Italian end struck soft material, through which it took six months to drive 150 feet of tunnel; and the cost of this stretch was $100,000.

The tunnel was opened last April. Two trains met in the middle, one being in charge of M. Brandau, the engineer who had conducted the work from the Italian side, and the other in charge of M. Rosemund, who had conducted the work in the opposite direction.

A New Brooks Comet.

A new comet was discovered by Dr. William R. Brooks, director of the Smith Observatory, and professor of astronomy in Hobart College, Geneva, N. Y., on the morning of January 26 at 15 hours. The position of the comet at discovery was Right Ascension 16 hours 19 minutes 30 seconds; declination north 47 degrees 10 minutes, with a moderate motion in a northwest direction. The new comet appears fairly bright, large, and diffused, with considerable central condensation and a very short tail. The comet is visible with a three-inch telescope, and at discovery was in the northern part of the constellation Hercules.

Burbank's Recent Experiments.

The experiments which Luther Burbank has under way are the most extensive ever carried out, but from their very nature valuable results, either practical or scientific, cannot be obtained at once. The pursuit of long periods of intensely careful and most accurate observations on a broad and comprehensive scale is the only course whereby results which will stand the test of time may be obtained. The laboratory and small field experiments of the past have never included enough species under study at the same time, and it has been impossible to draw general conclusions safely, as the different tribes and species of plants have each a slightly different story to relate. Very strong points are brought out by studying the results of these vast experiments, and much valuable material for thought will undoubtedly be found in the scientific account of the experiments.

Some of the experiments which have been carried on for the last 15 to 38 years are just coming to fruition. A partial list of the plants upon which work is now progressing includes 300,000 new hybrid plums, the work of the past 25 years in crossing about every known species, and about 10,000 seedlings of this year's growth (1905); 10,000 new apples; many thousand peach and peach-nectarine crosses; 8,000 new seedlings of pineapple quince; 400 new cherry seedlings; 1,000 new grapevines; 8,000 new hybrid chestnuts, crosses of American, Japanese, Chinese, and Italian species; 800 new and distinct hybrid walnuts, crosses of American black, Sieboldi, English, Manschurica, butternut, and others; many thousand apricots and plumcots; 5,000 select, improved, thornless "Goumi" (*Eleagnus*) bushes; very numerous other fruits in less numbers, and 10,000 new, rare, hybrid seedling potatoes.

For the past eight years Opuntias and other cacti have been secured from all parts of the world. Selections have been made and crossed and thousands of hybrid seedlings raised, some tender or hardy or gigantic or dwarf; some bearing gigantic fruits in profusion and others small ones of exquisite flavor. Some large groups have been developed which produce enormous quantities of nutritious food for all kinds of stock and poultry. This work promises well for science and economics. Perhaps the next in importance are the experiments on grasses and forage plants. Some new ones of great value are being produced and some of rare scientific value in the study of heredity and variation.—From the Year Book of the Carnegie Institution.

The Current Supplement.

The current Supplement, No. 1571, opens with an interesting article by Dr. Alfred Gradenwitz on a comparison between torpedo-boat and merchant-steamship engines. It seems that in one of the German shipyards two sets of engines, each of 3,000 horse-power, happened to be standing side by side, one destined for a merchant steamer, the other for a torpedo boat. The smallness of the torpedo-boat engine compared with the other was so great, that our correspondent thought the two would make a striking picture. The picture is published in connection with this article. Rear-Admiral George Melville continues his exhaustive discussion of liquid fuel for naval and marine uses. Lieut. Henry J. Jones concludes his admirable treatise on armored concrete. Mr. A. Frederick Collins presents a most thorough account of the De Forest syntonic system of wireless telegraphy. Interesting to automobilists is an illustrated description of a gasoline-motor-propelled roller. Franz Pabisch writes on a proposed solution of the problem of flight which is noteworthy, although not altogether unobjectionable. A short, but valuable, article is that on the transportation routes and systems of the world. One of the most valuable articles read before the recent meeting of the British Association for the Advancement of Science was that by Prof. A. E. Shipley on insects as carriers of disease. Mr. William Mayner writes on new uses of peat and various products in Germany. Maize, although an excellent food, may injure health if it be at all diseased. Hence the question of its preservation, especially during long ocean voyages, becomes of great importance. One of the simplest methods which have been devised for the preservation of maize during transportation is known as the Clayton process. This is clearly described. Dr. George F. Kunz writes instructively on the genesis of the diamond.

Correspondence.

Cement Drain Tiles Wanted.

To the Editor of the SCIENTIFIC AMERICAN:

I see by an advertisement in your paper that it is now possible to make good building blocks of sand and cement at a cost of six cents each—blocks worth eighteen cents each for use in building a house wall. This leads me to suggest that some one of the makers of machines for this purpose might do well for himself and others by inventing a machine for turning out tiles for farm drainage.

Good burnt-clay tiles three inches in diameter cost from ten to twelve dollars per thousand at the factory, but by the time they reach the back-country farmer the cost runs up to twenty-five dollars and often much more. I should suppose that a farmer who has sand at home could make cement tiles at a cost far below that, provided he had the right apparatus.

Of course, such a machine must be, first of all, simple, and to this end I venture to suggest that a tile with the cross section of the letter U might be easier to make than the tube tile. In fact, I have seen the Indians in Central America making roof tiles of that shape by laying the clay half way round a tree trunk of the right size. Better still, I think, might be flat tiles having one edge notched, so that when laid together like the sides of an A roof, they would dovetail together. If well designed, such a line of tiles would never get out of place, and it would drain the land in half the time required by the tube tiles.

JOHN R. SPEARS.

Northwood, N. Y., January 16, 1906.

The Heat of the Subway.

To the Editor of the SCIENTIFIC AMERICAN:

I would judge from the different articles that I have read that the excessive heat of the Subway is somewhat of a mystery, and in your last issue of the SCIENTIFIC AMERICAN you state that a large amount of it is probably due to the powerful action of the Westinghouse brakes. This I will admit is true as far as that goes; however, I will ask this question:

Is it not true that all of the electrical energy fed into the Subway is finally converted into heat in one way or another? I claim that it makes no difference whether the electrical energy is all used in heaters or in motors, the heat units of the current in both cases are exactly the same. If we use this electrical force through electric heaters, the conversion into heat is direct; if we use it to run motors, about 15 per cent goes into heat direct by losses in the motors, and the other 85 per cent goes into mechanical energy or power, which is again converted into heat by the friction of bearings, the brakes, and the wind resistance of the trains. There is no way to fool this natural law, and to make the motors act as generators will give the same amount of heat as the brake shoes for stopping the trains, unless such generators could be used for charging storage batteries, which afterward could be discharged outside of the Subway. Ventilation or cold storage pipes is the only remedy.

E. A. BARBER,
Superintendent Black River Traction Company.
Watertown, N. Y., December 30, 1905.

The Consequences of Water Diversion from the Croton Valley.

To the Editor of the SCIENTIFIC AMERICAN:

The processes of water gathering and sanitary protection of streams in the Croton valley have been going on since 1842, when the first gravity supply was introduced into New York. If these processes have any effect upon the development of a drainage area, whether beneficial or otherwise, this period of sixty years is long enough to afford trustworthy results of what takes place. Such results are not only interesting in pointing out the destiny of this particular valley, but are of importance as an indication of what will take place in other regions under similar conditions.

The Croton watershed of 360 square miles is wholly within the counties of Westchester, Putnam, and Dutchess. The townships which include the watershed are thirteen in number and are 413 square miles in area, so that the area affected by the water gathering constitutes 87 per cent of the area of the townships. The following table shows the population of all the townships in ten-year periods from 1850 to 1900, according to the census returns:

Year.	Population.
1850	24,323
1860	26,068
1870	26,408
1880	27,406
1890	26,405
1900	23,576

The gain in these townships for the ten years ended 1860 was 18 per cent; for the twenty years to 1870, 14 per cent; for the thirty years to 1880, 12 per cent; for the forty years to 1890, 7 per cent; for the fifty years to 1900, the loss was 3 per cent. During this same period of fifty years the State has increased in population 125 per cent; the county of New York, 300 per cent; the three combined counties in which the Croton basin is located, 113 per cent. The density of population of the townships comprising the Croton basin was 59 to the square mile in 1850, and 57 in 1900. In the combined counties of Westchester, Putnam, and Dutchess the density was 84 in 1850 and 179 in 1900.

The influence for retardation exhibited in the above census figures is remarkable for its persistence, inasmuch as the area affected possessed many features favorable for a normal growth. It contained thirty-one natural lakes and much beauty of scenery to attract residents. As early as 1852 the Harlem Railroad brought the entire length of the watershed into close connection with New York city. Without the presence of the water gatherer it stood in a good position to sympathize in development with the city, which has always had a record of doubling every seventeen years.

That there has been a positive influence against the progress of the townships comprising the Croton watershed is now made manifest and it may be recorded as an indisputable fact that the sanitary control and partial appropriation of land by the city for the purpose of diverting the maximum yield of water has in this instance resulted in retardation.

The question now to be answered by those interested in the welfare of the State is this: Will these same consequences follow the diversion of 500,000,000 gallons daily from the streams in the Catskill region? and, if so, whether or not the devotion in perpetuity of 900 square miles of drainage area is justifiable in the face of the fact that an equivalent supply may be obtained without resorting to the process of diversion at all, namely, by conserving the rainfall at the sources of the Hudson River for the twofold purpose of flood protection and the generation of electric power, the latter to be transmitted by wire to a station near Poughkeepsie and there utilized to pump the river water through an aqueduct to New York. Under this project the expenditure by the city does not injure the inhabitants of any extent of country, but on the contrary equalizes the flow of streams and aids in industrial development.

The estimated cost of the Catskill gravity project is $161,000,000, and the estimated cost of the Hudson River pumping project is $108,000,000, showing a difference of 30 per cent in favor of the latter. This wide difference is due to the fact that the required storage in the Catskill region will cost over $50,000,000, while the required storage on the upper Hudson will not cost $3,000,000. It would be utterly impossible to spend $50,000,000 in providing storage for a daily supply of 500,000,000 gallons anywhere in the State except in the Catskill Mountains. The topography of the country explains that fact fully, but the following quotation from the report of Mr. G. W. Rafter, C. E., to the Water Storage Commission points out how favorable in comparison is the topography of some other watersheds for storage. "These several reservoir systems (Hudson, Genesee, Salmon, and Black rivers) have a total capacity of 139,000 million cubic feet, an amount of water sufficient, if uniformly distributed, to produce continuously, under the existing conditions of fall on the various streams, about 400,000 horse-power, worth at $12 per year per horse-power, $4,800,000. But $4,800,000 is the interest on $120,000,000; hence this amount of money could be actually invested in combined flood protection and water storage for power purposes before the project would become commercially impracticable. As a matter of fact, the storage system here outlined will not exceed in cost $17,000,000." The average cost for storage for each horse-power in these four river systems is accordingly $42.50, and at this rate the 55,000 horse-power necessary to pump 500,000,000 gallons of water daily from the river to an elevation of 400 feet can be provided in the upper Hudson watershed by the expenditure of $2,237,500.

By the generation of electric power at the source of the Hudson and the utilization of this power down stream one hundred miles or more an economy will be brought about that will save the city more than forty million dollars and save the State from sacrificing to the water gatherer what properly belongs to the tax gatherer.

R. D. A. PARROTT.

100 East 17th Street, New York, January 22, 1906.

ORE-UNLOADING BY MACHINERY.

BY DAY ALLEN WILLEY.

A new unloading apparatus has recently been placed in operation on the Great Lakes for unloading cargoes of ore and coal. It differs radically from other apparatus for the reason that there is no cantilever and cable bucket system employed for unloading. It might be called a gigantic hull dredge, for in its operation it is quite similar to the modern dredge. The Hulett ore unloader, as it is termed, is undoubtedly one of the most perfect types of vessel unloader which has yet been designed, for it not only removes the material from the hold but literally cleans up the bottom of the ship, so that practically no hand labor is required. This is due to the design of what is termed the unloader leg. As the illustration shows, this is one of the most massive parts of the unloader, yet is so adjusted that it can be moved back and forth in the hold. The bucket itself, however, is so ingeniously constructed that, as already stated, it removes practically all of the ore, since it can be adjusted to the shape of the hold. The bucket, as generally constructed, is of ten gross tons capacity, and opened and closed by hydraulic power when steam is used, or by specially designed motors in case electricity is the source of power. The total spread of the bucket when wide open is over 18 feet, and by telescopic motion can be made to reach, when open, more than half-way from the center of one hatch to the center of the other. It also travels lengthways of the hatch to the sides of the boat; consequently the operator is able to reach almost the entire cargo. In an ordinary boat there is no difficulty in reaching 90 per cent of the cargo, and in some of the compartment boats the machines have actually unloaded 97 per cent without the help of shovelers.

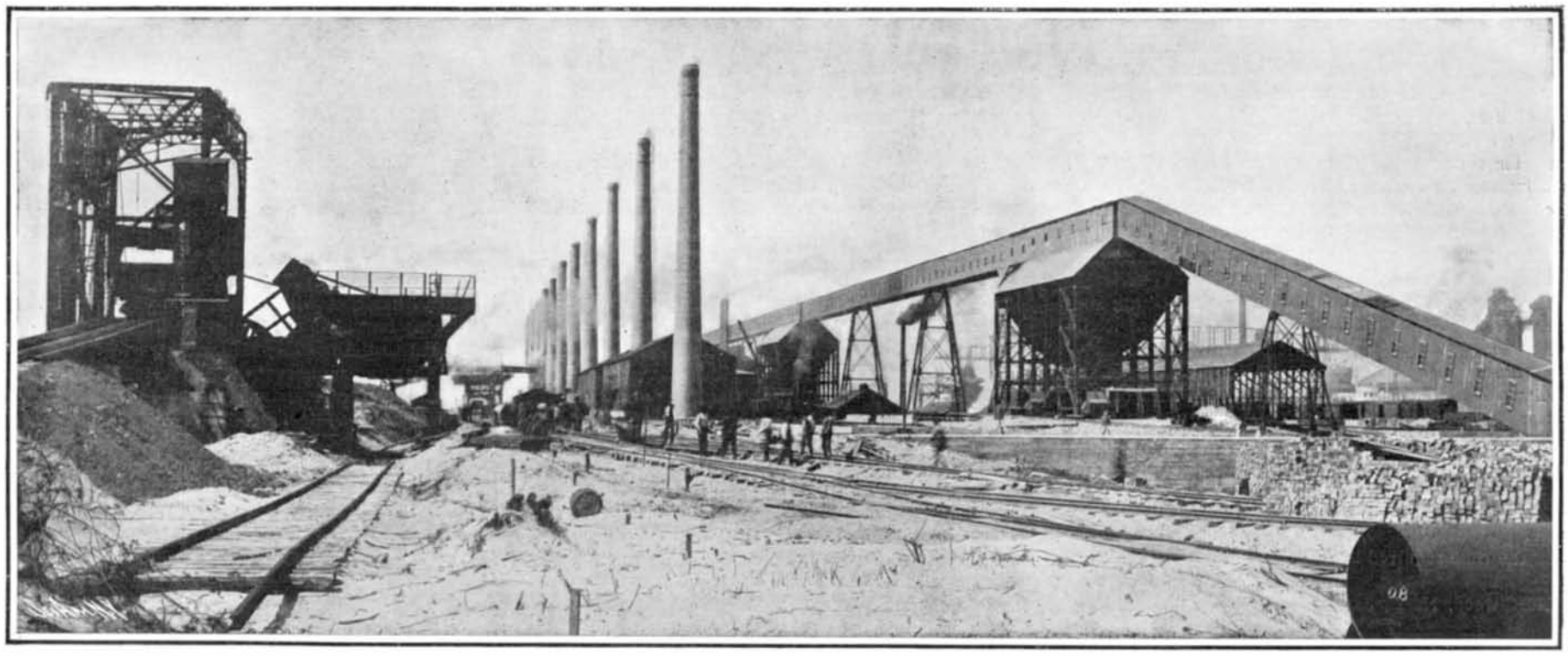
The leg to which the shovel is attached is in turn connected to the beam, which answers to the beam of the ordinary steam shovel. It is pivoted, however, and mounted upon a massive truck. In operation, the walking beam, as it is called, is run out upon the truck until the unloader leg with its bucket is over the section of hold to be emptied. The beam is then lowered until the bucket has reached the material and the mechanism controlling the bucket set in motion. When it is filled the movements are of course reversed, the beam raised and moved inward until the bucket is in position to discharge its contents. The truck frame carrying the walking beam consists of two parallel girders mounted upon truck wheels, the girders being installed at right angles to the face of the dock. Between these girders are set hoppers into which the contents of the bucket are deposited. Where the unloaders are used for transferring ore from vessels, the material taken out may be carried some distance to the furnaces or to stock piles adjacent to the wharf. Where the ore is to be carried away by rail, the receiving hoppers are located above the railroad track so that as fast as cars are drawn along beneath, they can be filled by gravity. Where the ore is to be placed on the stock pile the cantilever conveyor is utilized, and is attached to the other end of the unloader, the hoppers being unloaded into the series of buckets which it carries. By means of the cable and trolley, the ore is distributed upon the stock pile as desired.

The unloaders can be operated either by steam or electric power. On the steam-operated machines the power is supplied by a boiler of heavy locomotive type and 175-horse-power capacity, which operates a steam pump capable of supplying the necessary amount of water at 1,000 pounds pressure per square inch. Hydraulic cylinders are used to open, close, and rotate the bucket, to move the trolley and to raise and lower the walking beam. An independent steam engine supplies the power for moving the machine along the docks and for the haulage of the bucket car. On the electrically-operated machines the power is supplied from motors which take their current through sliding contacts, from lines laid along the dock. The motors for operating the bucket are of 80 horse-power, those for hoisting the walking beam are 150 horse-power, for trolleying in and out 50 horse-power, and for operating the bucket car and moving the machine 260 horse-power. The controllers are of magnetic type especially built for heavy service.

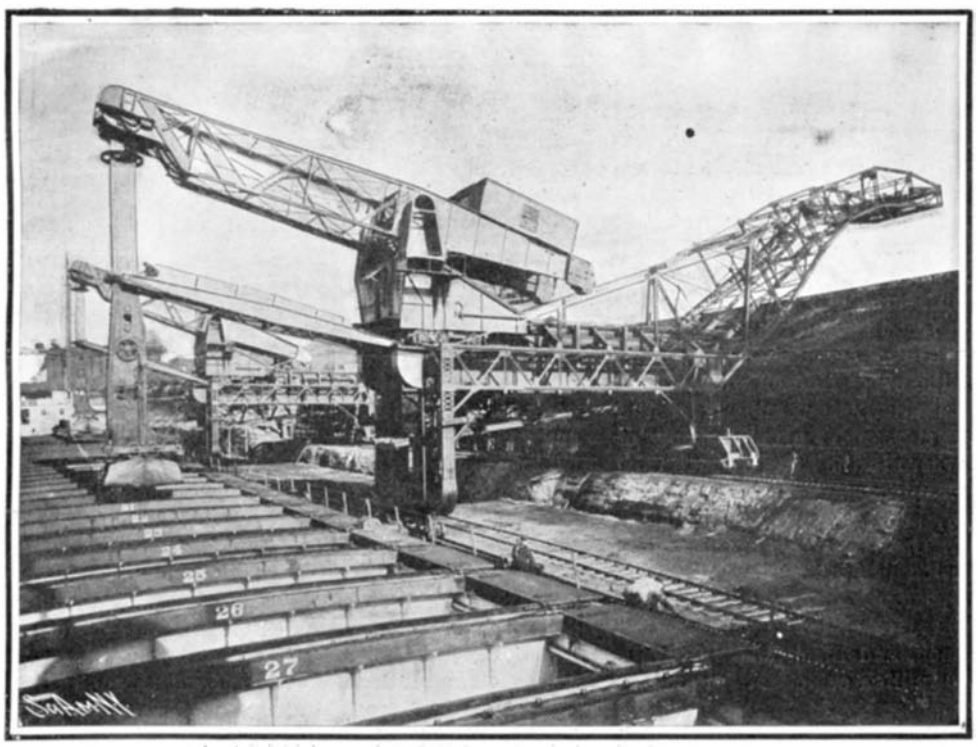
In spite of its capacity the mechanism is so compact that only three operators are required to each unloader. The bucket operator, who rides into the hatch and out over the dock with his bucket, controls all motions of the machine, except travel from hatch to hatch and operation of the bucket car, his position in the bucket leg enabling him to watch the work to best advantage. Another operator is required for moving the machine from hatch to hatch and for controlling the bucket car. On the steam-operated machines a fireman is also necessary. On the electrically-operated machines an extra man is usually provided for oiling and adjustments.

The advantage of this mechanism in connection with large smelting plants has caused it to be installed at the works of the Lackawanna Steel Company at Buffalo—an industry which has possibly a greater variety of material conveyors than any other in the world. Here a single unloader will remove cargoes of ore at the rate of nearly 300 tons an hour, taking out 95 per cent of the cargo without the assistance of hand shovelers. Other apparatus installed at the Buffalo works includes a car dumper which is also notable for its design and capacity. It is utilized to carry coal intended for the coke ovens of the Lackawanna Company, and consists of a rotating cradle supported on a rectangular framework. When the car is pushed upon the platform of the dumper it is clamped into the cradle, raised to the proper elevation, and then inverted to such an angle that its contents fall into the dumping bin through a chute. From this receptacle the coal is carried by means of endless conveyors into the receiving bins. By this plan all of the fuel re-

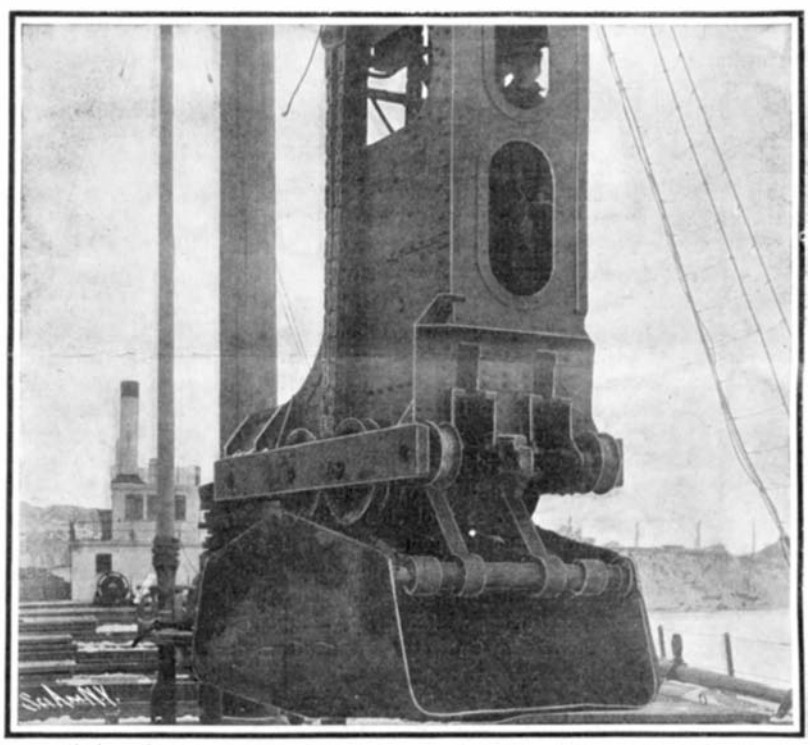
quired for the coke ovens can be transferred from the railroad cars and stored without the employment of any manual labor save to control the operating machinery. This car dumper will handle from 500 to 600 tons an hour, and is also operated by electric power, ing the ovens. As the illustration shows, the towers supporting them are mounted upon movable trucks and inclose two standard-gage railroad tracks, so that two trains of cars can be loaded at one time. The coke is conveyed from the ovens in pan hoppers suspended capacity of this apparatus can be gained when it is stated that at present nearly ten per cent of the entire ore tonnage carried from the ranges on Lake Superior to the smelters, is taken out of the vessels by this means. To further facilitate their work a number of



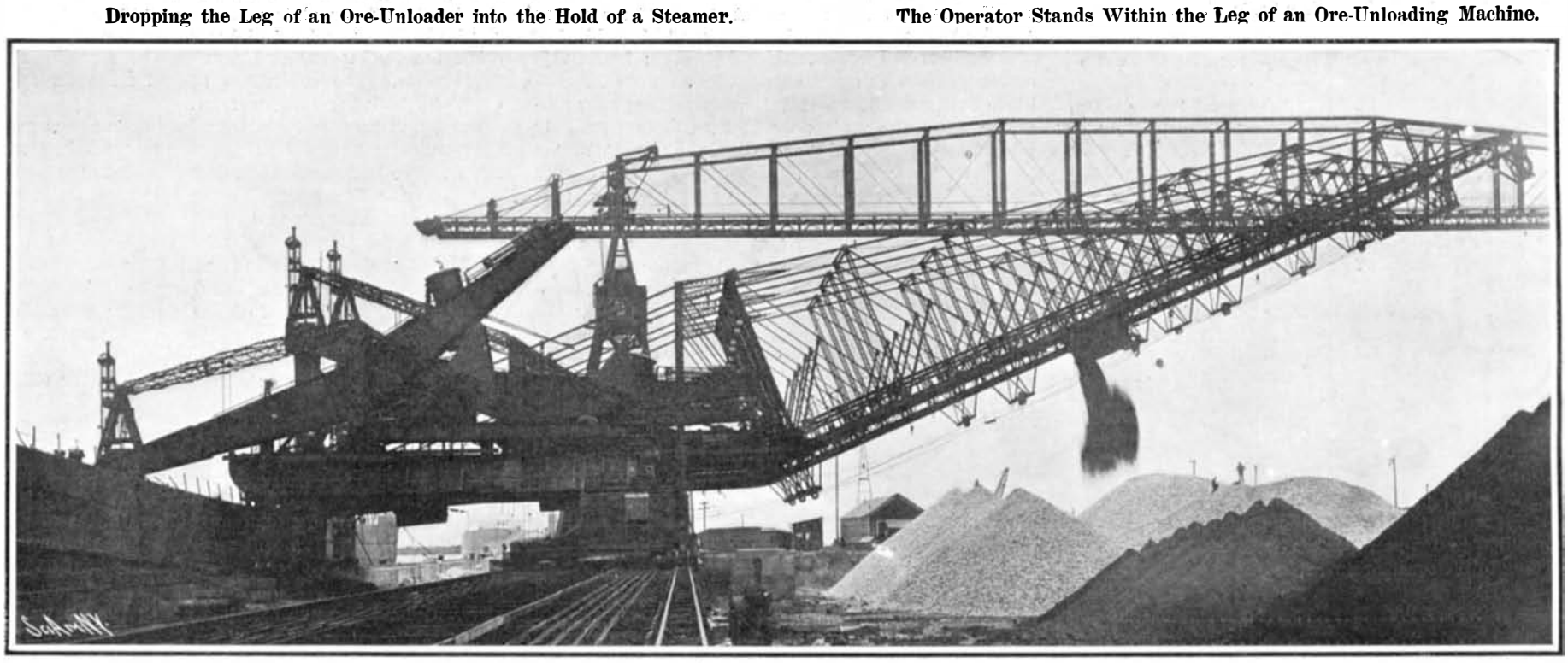
A New Type of Car Dumper. The Car is Being Lowered into the Receptacle at the Left of the Photograph.



Dropping the Leg of an Ore-Unloader into the Hold of a Steamer.



The Operator Stands Within the Leg of an Ore-Unloading Machine.



Ore-Unloader in Service. The Ore is Being Discharged from the Bucket onto the Stock Pile.

ORE-UNLOADING BY MACHINERY.

the motor equipment consisting of two 80-horse-power motors for the tipping mechanism and one 30-horse-power motor for haulage.

In connection with the coke ovens is a series of electric cranes which are devoted exclusively to serv- from the top of the crane by chains. In loading a car the pan can be tilted at any angle desired, and automatically emptied, as shown in the illustration.

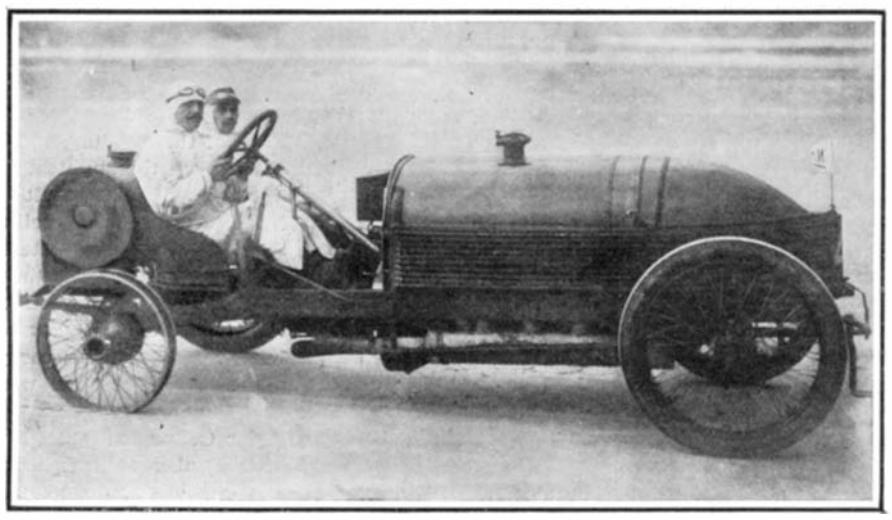
Referring again to the method of unloading vessels by the leg and bucket device, an idea of the enormous the larger ore carriers have been constructed with holds divided into a series of compartments. Where a vessel is thus designed, it is a fact that cargo can be almost entirely removed—not over 3 per cent being placed in the bucket by hand labor, as already stated.

FINAL RACES AT THE ORMOND AUTOMOBILE MEET.

Subsequent to the writing of the report of the races at Ormond Beach, Fla., given in our last issue, a number of interesting races were held on January 27 and 29, the last two days of the meet.

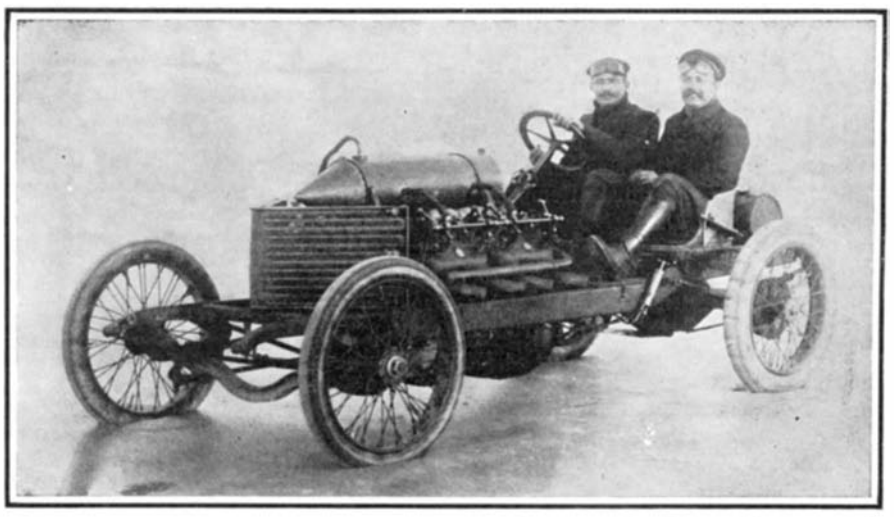
The event of the former day was the 100-mile race, which was run over a 15-mile course requiring six turns. Two English Napier machines—a 100-horse-power, 6-cylinder racer, and an 80-horse-power, 4-cylinder car—were the star performers in this event, as the former won the race after running 65 miles on the rim of one of its rear wheels, while the latter Earp on his 100-horse-power Napier at the end of 50 miles. At this point he lost a tire, and consumed 7 minutes in replacing it. Earp passed him, and gained sufficiently to stay in the lead during the second half of the race. His lead of 2½ minutes thus obtained was reduced to only 58 3/5 seconds, however, at the finish, although he was still 2 minutes and 26 seconds ahead at the 70-mile point. The right-hand rear tire of his machine came off after he had gone about 35 miles, and he ran the balance of the race on the rim without stopping. Our photograph, which was taken late in the afternoon just after the finish, shows the horse-power De Dietrich, and was an increase in speed of but 3¾ miles per hour. The Napier machine has the same engine that was used in the races last year. In fact, with some minor changes, it is the same machine which, in the 1905 meet, covered 10 miles in 6:15 at 96 miles per hour—a record which still remains unbroken. Its 80-horse-power mate was third in 1:20:05, while Cedrino's Fiat obtained second place in 1:16:39.

Among the races run on January 29 were a 10-mile open handicap and a 15-mile championship race, both of which were won by Lancia in 6:18 2/5 and 10 min-



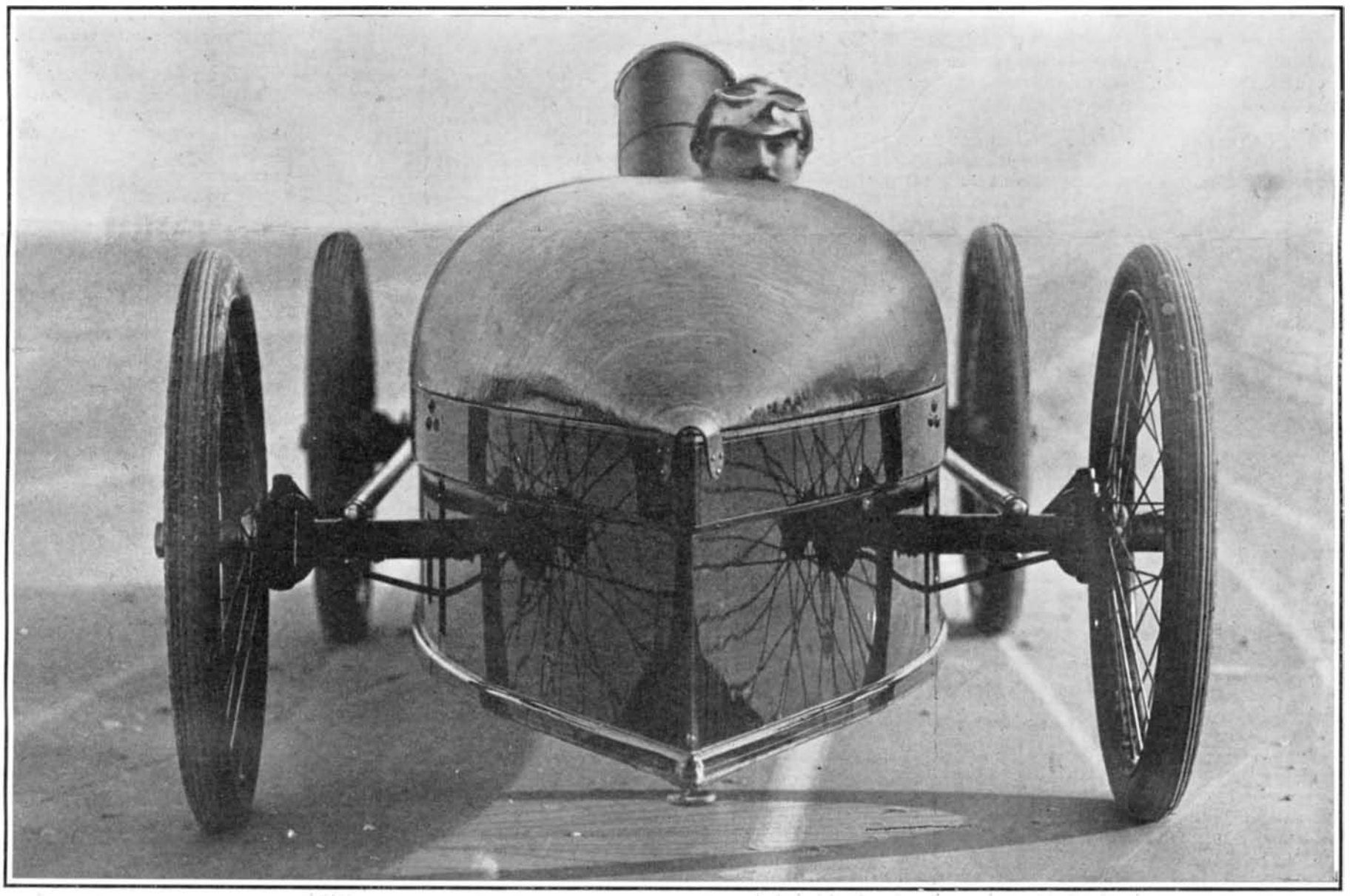
The 100-Horse Power, 6-Cylinder Napier Racer Driven by Earp, as It Appeared at the Finish of the 100-Mile Race. The Last 65 Miles Were Run Without a Tire, as Shown.

This machine covered 100 miles in 1 hour, 15 minutes, 40⅘ seconds, at a rate of speed of 79.28 miles an hour. It reduced the 100-mile record by 2 minutes and 44 seconds. An 80-h.p., 4-cylinder Napier was third in 1:20:05.



The 200-Horse-Power, 8-Cylinder Darracq Racer with Demogeot at the Wheel. This Car Was Specially Built for the "Two-Miles-a-Minute" Race, Which It Won.

After reducing the kilometer record 1 second in France last December, this car succeeded in covering two miles in 58⅘ seconds on the beach at Ormond. This is equivalent to a mile in 29⅘ seconds—a speed of 122.46 miles an hour—and is the fastest time ever made by a gasoline automobile.



The 50-Horse-Power, Light-Weight, Stanley Steam Racer—the Speediest Self-Propelled Vehicle Ever Built—Which Came Within 2¾ Miles an Hour of Equaling the Highest Speed Attained by an Electric Car Running on Rails—130.4 Miles an Hour.

In the mile speed trials this machine covered that distance in 28⅕ seconds—a rate of speed of 127.65 miles an hour—while in the "Two-Miles-a-Minute" race it consumed 59⅘ seconds, which is equivalent to a speed of 120.8 miles an hour. It also won the 30-mile race for American machines in 34 minutes, 18⅘ seconds.

RECORD-HOLDING RACERS AT THE ORMOND AUTOMOBILE MEET.

finished third only 4 minutes 24 3/5 seconds behind its mate. Besides these two cars the starters included two 110-horse-power Fiat machines driven by Lancia and Cedrino, Chevrolet on the 100-horse-power Christie, and Harding on a 45-horse-power English Daimler. The 80-horse-power Darracq Vanderbilt cup winner was ruled out because it had no differential gear. The Christie and Daimler machines quit the race before covering half the distance. Lancia lost a tire soon after covering 40 miles, and shortly after a leak developed in the radiator, which put him out of the race. Cedrino was 4½ minutes ahead of wheel minus its tire and the intrepid driver with his mechanic. Under the extremely unfavorable condition of running on the rim about half the distance, Earp covered 78 miles and made five turns in 52 minutes and 57 seconds, or at the rate of 88.48 miles an hour. Cedrino also broke a record by covering 40 miles in 25 minutes and 6 seconds, or at a rate of speed of 95.61 miles an hour.

The race was won by Earp in 1 hour, 15 minutes, 40 2/5 seconds, or at a rate of speed of 79.28 miles an hour. This was only 2 minutes and 44 seconds better time than was made last year by Fletcher on an 80-utes respectively, with Hilliard on the 80-horse-power Napier second in 8:03 4/5 and 11:36 3/5. The 30-mile race for American cars had but three competitors—the Stanley steam racer and the 100-horse-power Christie and Ford machines. The last-named car ran into the soft sand at the 15-mile turn and was stuck fast. The Christie car had trouble from overheating, and was obliged to renew its water supply at the club house within 4 miles of the finish. The Stanley steamer started 5 minutes and 40 seconds after the other cars. When passing the club house, Mariott slowed it down, thinking he was at the finish. He found out his error

and made a spurt, finishing in 34 minutes 18 2/5 seconds, with Christie some 3 minutes behind him in 37:24 3/5.

The final and most interesting event was the "two-miles-a-minute" race. The only competitors were the 8-cylinder, 200-horse-power Darracq, and the Stanley steamer. As recorded in this journal last week, the steamer had previously covered a mile in 28 1/5 seconds, at the rate of 127.65 miles per hour. In the "two-miles-a-minute" race both machines were obliged to make two trials. These attempts were made separately. The first one, which was made by the steamer, resulted in the comparatively slow time of 1:03. The Darracq did much better than this, although one or two of its cylinders were missing fire, and on its first trial it consumed only 3/5 of a second over a minute. The second attempt of the steamer resulted in 59 3/5, or 29 4/5 seconds to the mile, which was a rate of speed of only 120.8 miles per hour—7.85 miles per hour less than the steamer had previously done in the mile trials. A third attempt at the record was not allowed. The Darracq machine made a slightly faster showing. It covered the two miles in 58 4/5 seconds. This is equivalent to 29 2/5 seconds to the mile, or 122.46 miles per hour. This machine, like the Stanley, was especially constructed for the "two-miles-a-minute" race. Its engine is twice the size of that in the 80-horse-power racer which won the Vanderbilt Cup race last October. The eight cylinders are set at an angle of 90 deg., forming a V. They are 170 millimeters (6.692 inches) bore by 140 millimeters (5.511 inches) stroke, and they have a total piston displacement of 1,551.68 cubic inches. The present racer has the radiator arranged to form a sharp prow, and the cylindrical water tank is also pointed. While this may make some difference in the air resistance, the fact remains that, roughly speaking, it has required a doubling of the horse-power to make an increase of one-third in the speed. If the same ratio holds, to obtain a speed of 150 miles per hour with a gasoline machine, at least 350-horse-power would be required. How these figures compare with those of the steam racer may be seen from the following facts regarding the latter which have been sent us by the inventor, Mr. F. E. Stanley.

The wheel base of the racer is 100 inches and the tread 54 inches. The rear or driving wheels are fitted with 34 x 3½, and the front wheels with 34 x 3-inch standard G. & J. clincher tires. The wheels are of the wire spoke type, the tires being bolted to the rims with eight tire bolts and being so perfectly balanced with counter weights that there was no vibration when the wheels were making upward of 1,200 revolutions per minute. The running gear is the same as that used on the Stanley touring car with the exception of the wheels, which have wire instead of wooden spokes. The body of the car is built entirely of wood, and mounted on four full-elliptic springs. The springs are placed on the inside of the body, so as to reduce the air resistance to a minimum. Ball bearings of the two-point type, with ¾-inch balls, are used in the running gear.

The body is 16 feet long and 3 feet wide at the widest part. It is pointed in front, and terminates at the rear in a circle with 8-inch radius, tapering to 2-foot width and to the point in front with cycloidal curves, or curves with constantly diminishing radius. The bottom of the car is perfectly straight and smooth. It has a clearance of 10½ inches. The sides are vertical to a height of 18 inches, and from that line the removable top is oval, curving both transversely and longitudinally. The largest cross section, including the wheels, amounts to 9 square feet.

The power plant consists of a boiler 30 inches diameter and containing 1,476 tubes of 33-64 inch outside diameter and 18 inches long. The boiler contains 285 square feet of heating surface. The steam was superheated, by passing it through tubes surrounded by the contents of the boiler and through coils of pipe in the fire box, to a temperature of about 700 deg. F.

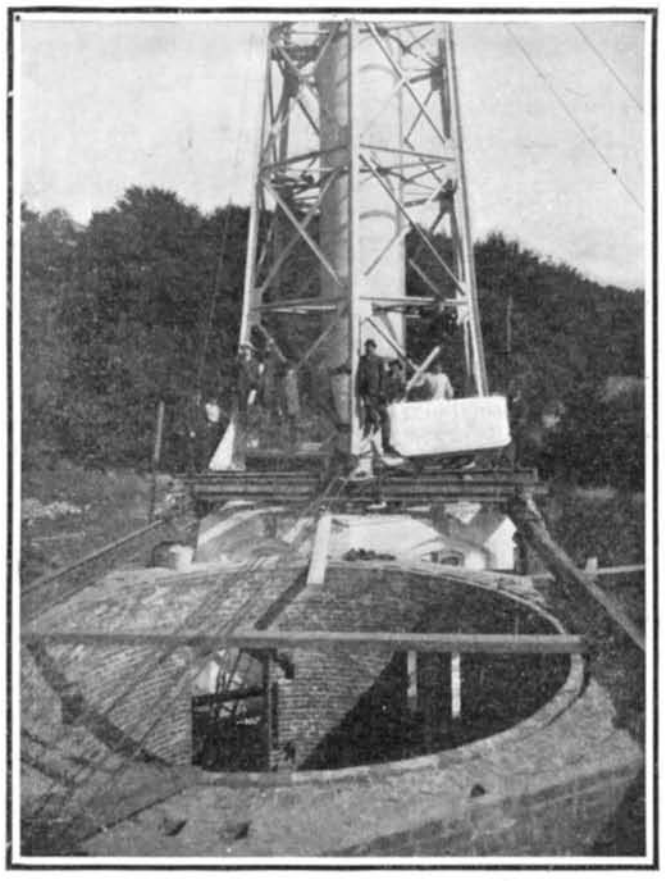
The engine is of the two-cylinder double-acting type, with cylinders 4½-inch bore by 6½-inch stroke. It is fitted with Stephenson link valve gear and D slide valves. The engine makes 350 revolutions to the mile, while the 34-inch driving wheels make 600 revolutions to the mile. Linked up as the engine was in forward gear, the cut-off was about one-third stroke, and the mean effective pressure about one-half the steam-chest pressure. The engine therefore develops 6 horse-power for each 100 revolutions per minute, and each 100 pounds steam chest pressure. The boiler will furnish steam for 50 horse-power continuously, and more than twice that amount for three minutes or more. About 275 pounds to the square inch steam pressure is carried.

The arrangement of parts of the power plant is as follows: The boiler is placed just back of the center of the body, the water tank between that and the rear axle. The engine is geared to the driving axle by spur gears, and is placed horizontally at the rear of the axle, so that the driving force of the engine tends to lift the front axle and transfer the load to the rear axle, thus giving the greatest possible traction to the driving wheels.

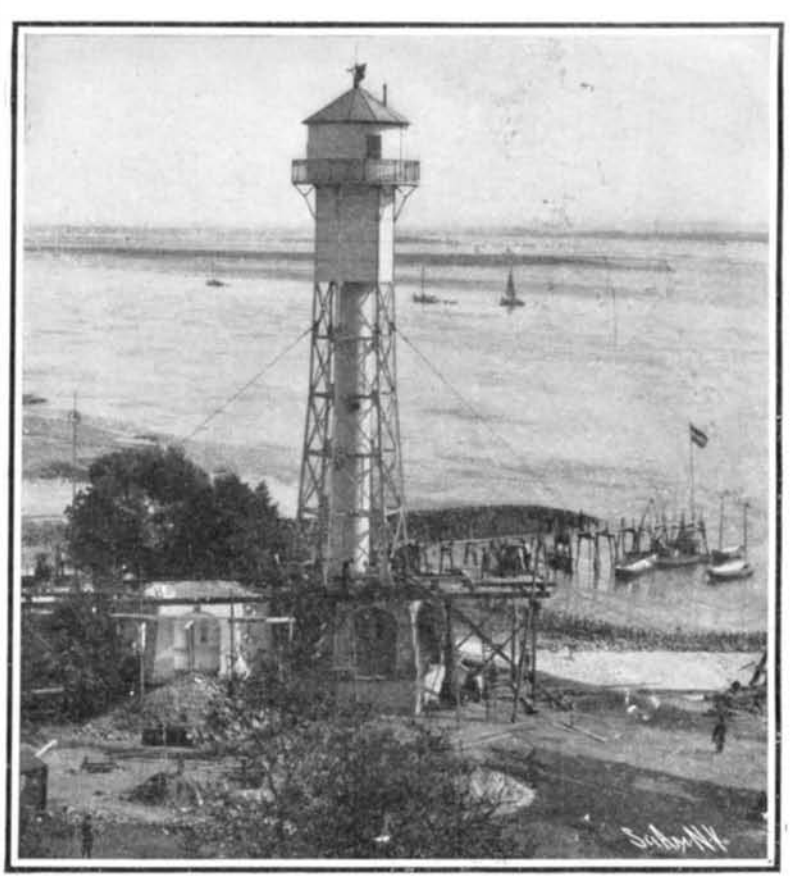
In making the record of 28 1-5 seconds for the mile, the power developed was probably about 120 horse-power. The engine made 750½ R. P. M. and the 34-inch driving wheels 1,286½ R. P. M.

The total weight of the machine was 1,675 pounds. The boiler weighed 525 pounds; engine, 185; burner and fire-box, 75; pumps, tanks, etc., 50 pounds; making the total power plant 835 pounds, or less than half the total weight of the machine.

Lighthouse During Removal.



The Lighthouse Before Removal, Showing the New Foundation.



Lighthouse After Removal.

MOVING A GERMAN LIGHTHOUSE.

BY DR. ALFRED GRADENWITZ.

Though the removal of buildings has long been a commonplace matter in American engineering practice, the readers of this journal will doubtless be interested in the following description of a removal work fraught with greater difficulties than the removal of even considerable masses, owing to the comparatively great height and small ground surface of the building, which was a lighthouse tower. In fact, even the slightest inaccuracies in preparing the slideway might result in considerable oscillations of the tower, while oscillations due to storms had to be prevented by lateral props. It should also be borne in mind that these lateral props had to uniformly follow the motion of the tower. This was effected by installing, in parallel to the sliding props, some girder constructions carrying crabs, and attaching to the latter the steel wire ropes propping the tower.

The Hamburg Department for Commerce and Navigation recently ordered the Wittenbergen lighthouse tower to be displaced with a view in future to avoid the continual dredging work necessitated by the alluvial sand. The width of the channel having to be increased from 142 to 200 meters, the Wittenbergen lighthouse was removed southward by about 9 meters. In order not to interrupt the operation of the lighthouse, arrangements had to be made that the tower might immediately find a solid foundation in its new position. The new foundation with all the necessary mooring, etc., was therefore made at a convenient location some 30 feet distance from the old place. The sliding way from the old to the new foundation was made of heavy ingot iron girders on which double coupled steel rollers moving the tower were allowed to run. The motion was effected with a strong hand-driven winch by means of a wire rope, while another winch was installed at the rear (with regard to the direction of motion) with a view to avoid any displacement of the tower in the case of storms. In addition there was a winch installed in front and another behind, the wire ropes from which were fixed on the top of the tower to avoid any oscillations. A special point was made of synchronism in the working of each of the winches. In order to protect the tower against oscillations due to lateral thrusts, two wire ropes connected to crabs were arranged on each side, these crabs running on girders mounted in parallel to the sliding way.

The whole of the removal work occupied 32 minutes. The lighthouse tower weighs about 60 tons, and is 115 feet high. The cost of the removal work proper, which was carried out by the contractors themselves, amounted to about 7,000 marks, exclusive of the masonry and carpentry work, executed by the Hamburg Hydraulic Engineering Department.

REMARKABLE ENGINEERING FEAT—MOVING A GERMAN LIGHTHOUSE.

Liquid for Sanitary Spraying.

A liquid for sanitary spraying, for use in the chambers of the sick, is composed of 10 parts of eucalyptol, 3 parts of thyme oil, as much lemon oil, and the same quantity of lavender oil, in 110 parts of alcohol of 90 deg. To a pint of water add a teaspoon of this liquid. —Jour. Parf. et Sav.

REMARKABLE PHOSPHORESCENT ANIMALS.

BY CHARLES FREDERICK HOLDER.

For some reason the Pacific coast of the United States, particularly California, has always been famous for its displays of phosphorescence—that strange phenomenon over which many men have spent years of study, and which, to a large extent, is still mysterious and unexplainable, though it should be said there are not theories and pseudo-explanations lacking.

The islands of Southern California from the Coronados to the Santa Catalina group of four, opposite Los Angeles County, to the Santa Barbara group of four in the channel of that name, are the points most available for observation, due to the peculiarities of the coast. The Coronados, Santa Catalina, San Clemente, Anacapa, Santa Cruz, Santa Rosa, and San Miguel all lie more or less parallel to the coast, affording that necessary feature for extended investigations—a perfect lee; the water often being so smooth that it is difficult to believe one's self at sea.

As these islands all rise out of the blue depths of the ocean, and are washed by offshore currents, they afford a remarkable field for the zoologist, and it can be said that there is hardly an animal obtainable from the Naples aquarium that cannot be found, or its prototype, along these shores from Point Conception above Santa Barbara to San Diego. The observer is particularly impressed with the richness of the invertebrates found here, ranging from giant jelly fishes twenty feet in length, which in all sizes often appear to fill the sea, to the graceful Porpita, Velella, and Physalia, and during the late winter months the delicate paper nautilus is sometimes found, and has been kept alive and watched.

Students of animal phosphorescence have read of the Pyrosoma, one of the Ascidians whose wonders of light have made it famous. One of these beautiful animals was caught off Avalon Bay some time ago, and in all probability the first photograph of the animal ever taken is shown in the accompanying illustration. It was first seen as a blaze of light as large as a bucket, ten or more feet below the surface, and supposed to be a large jelly fish; but as it was watched through the window of a glass-bottom boat, it was seen to rise and to be long and cylindrical. The finder called it a "fire barrel," not an exaggeration, as when the strange object reached the surface it was seen to be barrel shaped, about a foot in length, open at one end and emitting a faint light; but the moment it was touched as the finder placed his hands beneath it, it blazed out in a vivid glare of green silvery light. The discoverers were not naturalists, but they saw that the animal was alive, and that a stream of water was pouring from the open end, forcing the strange object along. It was caught in a pail and successfully placed in a tank, and doubtless the first large Pyrosoma seen alive in America was closely observed. It would be difficult to exaggerate the beauties of this animal. In a specimen the writer kept in a dark room in the Gulf of Mexico, by stirring it with a stick, light was produced sufficient to read medium-size print, and the sight was a ghostly one, the large type standing out with marvelous distinctness.

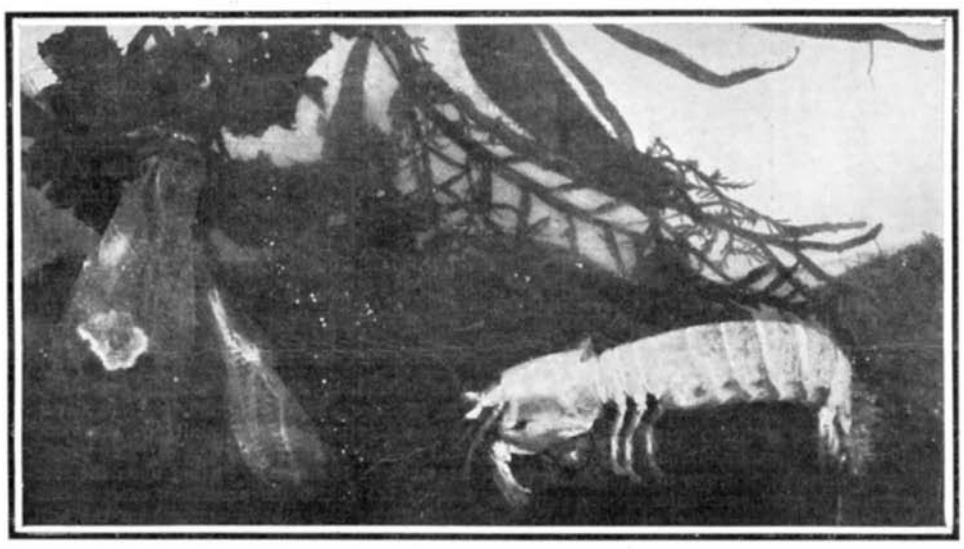
At certain times the Pyrosoma is fairly common in the San Clemente channel, but specimens larger than a foot or so have never been seen. It is in the tropics that the animal is at its best. Moseley describes one as follows: "The most beautiful kind of phosphorescence is, however, that of the Ascidian colony of Pyrosoma. This, when stimulated by a touch, a shake, or a swirl of the water, gives out a bright globe of bluish light which lasts for several seconds . . . and then goes out suddenly. A giant Pyrosoma was caught by us in the deep-sea trawl. It was like a great sac, with its walls of jelly about an inch in thickness. It was four feet long and ten inches in diameter. When a Pyrosoma is stimulated by having its surface touched, the phosphorescent light breaks out just at the spot stimulated and then spreads over the surface of the colony to the surrounding animals. I wrote my name with my finger on the surface of the giant Pyrosoma as it lay on deck, and my name came out in a few seconds in letters of fire."

The Pyrosoma, as soft, jellylike, and insignificant as it appears, stands high among the great branches of animal life, being a tunicate in the order Chordata, leading up to the fishes, the larvæ of some forms showing a notocord believed to be a primitive vertebra or backbone.

Humboldt has described the radiant beauties of these fire bodies as he saw them like stars in the bed of the ocean; and so brilliant was their light, that he could distinguish fishes by their radiance. The Pyrosoma or fire body has on many occasions astonished observers by its splendid light that varies in tint and color. Thus those observed by Bennett, the English naturalist, gave out a splendid pale greenish light, while M. Peron, the French zoologist, met a school of them near the Isles of France, and describes them as resembling

Luminous Living Heteropod from Avalon Bay, California.

"red-hot balls of iron." In all probability, Bibra, the Brazilian naturalist, was the first to utilize their light when he placed six small specimens in a swinging glass in his cabin, and used their brilliant light as a lamp, by which he wrote a description of the animals and their beauties. Sir Wyville Thompson, referring



Salpa (*Cyclosalpa affinis*). Squilla.

Photographs of Two Living Luminous Animals.

to the blaze of phosphorescence and train of intense brightness that followed the ship, while he did not use them in his cabin as lamps, says: "It was an easy matter to read the smallest print sitting at the after port in my cabin; and the bows shed on either side rapidly widening spaces of radiance so vivid as to throw the sails and rigging into lights and shadows." The animal resembles faceted jelly, and is really a colony made up of innumerable pseudo-individuals bound together by insoluble ties. Each individual in feeding draws water from the outside and ejects it on the inner side; and as countless jets are being forced out, a stream is formed which forces the entire colony along in the direction it happens to be headed. The light of the Atlantic forms is an intense green, but in very large individuals it is blue. When handled, a peculiar albuminous substance is exuded that is also phosphorescent. The impression is conveyed that the entire animal is luminous, but this is not so. In the illustration little tubercle-like objects are seen covering the animal. Each indicates a zooid, and each of the latter has two luminous spots, according to Panceri, "situated over the position of the ganglia of the nervous system." At times the Pyrosoma does not show a light, but if it is disturbed or injured, the light will start at the point of impact, and spread with wonderful rapidity from point to point until the entire mass is ablaze with light.

It is well known that some of the most remarkable light-givers are crabs, and of all the crustaceans the one shown in the accompanying photograph is perhaps among the most interesting. The writer kept several from the Atlantic and the Gulf of Mexico, and had never noticed their phosphorescence. A large and beautiful specimen was dredged off Avalon Bay, California, and placed in a tank, that its beauties of color—red, blue, purple, and green—might be observed. It happened that in looking at the tank one night the squilla was seen to be surrounded by a peculiar light, which examination showed came from the ventral fillets, or some part of them, sufficient to make the strange crustacean stand out in lines of gold. The animal, at least in the Pacific waters, is a deep-water form, and one of the most attractive of all marine animals in its marvelous coloring. It is very active, having a wonderful swimming apparatus, darting about with great velocity.

In the waters, twenty miles off San Pedro, may be seen the Salpa, a wonderful light-giver. Chains of them ten or even twenty feet long have been placed in tanks, and their light witnessed at night. Of all the luminous animals, these are among the most wonderful. In the illustration the claspers are seen on the upper end. The light is confined to the so-called nucleus of the animal, and bodies of water twenty miles square have been seen glowing with light and color from them. In some, the light is silvery, in others red or blue, while some refuse to respond. The writer has seen the Santa Catalina channel, which is from eighteen to twenty miles wide and practically forty-five miles long, off Los Angeles County, so filled with these radiant creatures that as far as the eye could see they were the fraction of an inch above the surface and gleaming like gems in the sunlight. They constitute the food of the whalebone whales, and many of the large animals were seen at this time reveling every day in the delicacy.

The "Firebarrel" or Pyrosoma. Photograph from Life.

REMARKABLE PHOSPHORESCENT ANIMALS.

Interesting light-givers are the low Heteropods—the dazzling white, seemingly shapeless forms shown in the accompanying photographs. They float slowly in the water, and are common in Avalon Bay in summer, and often seen floating in the clear blue water. It is difficult to locate the seat of the light in them. Those observed by the writer, when irritated, gave out a light seemingly over the entire surface, but Giglioli refers to one in which the light was red and confined to the axis of the body. They are lowly but interesting creatures, with transparent bodies, a sucker-like organ by which they can cling to the weed, and a long powerful tail or swimming organ. Some of these forms have minute shells; others are shell-less. The Phyllirhöe, a free-swimming, sluglike mollusk, common here, is a brilliant light-giver; a dangerous possession, it would seem, as it is a signal that cannot fail to attract the attention of marauding fishes. The sight of these waters at night is at times awe-inspiring. One glances down into the depths, and sees myriads of forms passing and repassing, all blazing with this mysterious light.

The production of aluminium in the United States has increased nearly ten-fold in as many years, according to the annual report of the United States Geological Survey for 1904, which has just been completed. The output of 1904 was 8,600,000 pounds, as compared with 7,500,000 pounds in 1903, and 7,300,000 pounds in 1902. When it is remembered that the industry dates its beginning from 1883, in which year the production was 83 pounds, its rapid development will be appreciated.

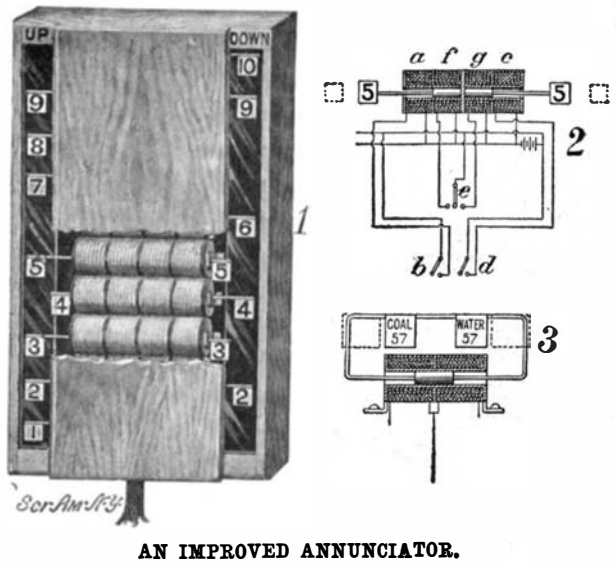
Action of Mineral Substances on Milk.

Experiments have been made as follows: (1) On lime in the form of milk of lime; (2) on chlorine, in the form of sea-salt; (3) on phosphoric acid (phosphate of lime); (4) on iron (neutral acetate of iron). The animals received as nourishment green herbage, *ad libitum*, and a daily ration of half a kilogramme of linseed oilcake and half a kilogramme of malt grains.

The results of the tests may be summed up as follows: (1) The mineral substances, lime, chlorine, iron, and phosphoric acid, in combination with the nourishment of the cows, do not sensibly modify the quantity of the milk produced, or its proportion of fatty matters. (2) The total percentage of ash in the milk of the cow is very constant; it is scarcely influenced by the absorption in noticeable quantities of mineral substances. (3) Among the mineral substances experimented on in analysis, lime is that which is found in the most variable proportions in the ash, proportions which may be somewhat influenced by the alimentation. (4) The percentage of lime in the ash may be raised by several centesimal units (3 to 6 per cent) from the fact of the absorption by the animals of important quantities of lime. (5) This absorption may augment, not only the percentage of lime in the ash, but also that of a given quantity of milk. (6) The increase of the percentage of lime in the ash or the milk takes place, not only with the absorption of caustic lime, but also with that of lime phosphate. (7) Nevertheless, the increase in the percentage of lime in the milk consequent upon the alimentation is so slight that it is of no importance in regard to the properties of the milk; besides, it is restricted to narrow limits of the percentage of lime in the produce of different cows. (8) The absorption of sea-salt by the animals does not increase the percentage of chlorine. Even for portions higher than the animals can support, the increase in the percentage is scarcely perceptible. (9) The percentage of chlorine in the milk increases very considerably with the progress of the period of lactation, independently of saline alimentation. (10) The percentage of phosphoric acid, as well of the milk as of its ash, is not at all affected by considerable quantities of this substance, at least in the form of lime phosphate. The question whether the increase of the proportion of phosphoric acid in the milk only fails when this already contains a high proportion of it, has not yet been settled; it is not impossible that in the case of a milk otherwise poor in phosphoric acid, this proportion may increase as a consequence of a phosphate alimentation. (11) The percentage of iron in the milk is not sensibly affected by alimentation.—Condensed from the French of M. Schulte. Communication to the Fédération Internationale de Laiterie.

AN IMPROVED ANNUNCIATOR.

A recent invention provides an annunciator in which there are no mechanical devices of any kind for moving the signals into view. Instead, a series of solenoids is used and the signals are attached to the floating cores of these solenoids. Each solenoid comprises two coils, one of which is energized to move the signal into view, while the other is used to withdraw the signal. The core is either square or oval in cross section and fits into a bore of similar outline. This holds the signal in an upright position, preventing it from falling over. In Fig. 1 we show the annunciator as applied to an elevator car and a diagram of the electrical connections is shown in Fig. 2. It will be observed that the solenoids are arranged in pairs, those on one side for operating the "up" signals, and those on the opposite side for operating the "down" signals. The outer coils, *a*, of the "up" solenoids are respectively connected to the switches or buttons, *b*, on the different floors, and the coils, *c*, of the "down" solenoids are connected to the buttons, *d*. The operator can thus signal his desire to ride up or down from any floor, in the usual manner. The inner coils of the solenoids are all operated by a common switch, *e*. The switch may be thrown to one side to energize the coils, *f*, and thus withdraw all the "up" signals, or to the other side to energize the coils, *g*, and thus withdraw the "down" signals. The absence of any levers or other mechanical devices for moving the signals renders the apparatus very compact. The annunciator illustrated measures but 5 inches by 8½ and is only 1¾ inches thick. It can be used either on a main or a battery current and can be wired to withdraw any single signal on either the "up" or the "down" side or to withdraw all the "up" and "down" signals at a single touch of the push button. In Fig. 3, a modification is shown which may be used in hotels. The solenoids comprise two coils as in the construction just described, but each solenoid is arranged to exhibit either of two signals. When one coil is energized one of the signals is brought into view and when the other is energized the other signal is exhibited. The signals are withdrawn by energizing both coils at once, when the core is moved to the neutral position, as shown in the drawing. Messrs. James and William Patten, 2535 Eighth Avenue, New York city, N. Y., have recently procured a patent on this improved annunciator.



AN IMPROVED ANNUNCIATOR.

Aeronautical Note.

In addition to the $10,000 prize already offered by M. Deutsch for first covering a certain specified course in the air above Paris with a flying machine of the "heavier than air" type, this gentleman has recently given a $2,000 challenge cup which is to be competed for by all kinds of aeronautical apparatus and which will be held permanently by the club which wins it three years in succession. The airship or flying machine that goes 100 kilometers (62 miles) to a specified point and returns to the starting place in the quickest time will be declared the winner. A cash prize of $4,000 will be given in 1906, 1907, and 1908 to the man who pilots the winning machine. Capt. Ferber, of the French army, is having built by the Buchet Company a light-weight motor for a motor-driven aeroplane with which he expects to compete for the Deutsch prizes.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC SWITCH FOR STREET ARC-LAMPS, ETC.—P. H. F. Spies, New York, N. Y. The object of the inventor is to provide a switch more especially designed for street arc-lamps, chandeliers, and the like and arranged to keep the main-line circuit completely uninterrupted whenever the lamp is cut or lowered for the insertion of new carbons or for repairs or other purposes, the lamp on being returned to its normal position being immediately and automatically cut in without interruption of the main-line circuit.

Of Interest to Farmers.

SICKLE.—P. E. Fletcher, Ridge, Ore. This sickle mechanism is designed to be used in connection with a harvester, reaper, or binder, the object being to provide a mechanism that will be of comparatively light draft, thus requiring but little power to run it, and further, to employ a very thin sickle-blade that may be readily sharpened with an emery-wheel without removing the blade from the machine.

COMBINED SEEDING AND MANURE-SPREADING MACHINE.—D. Toscani, Rocca Imperiale, Italy. The object of the invention is a machine which opens furrows in the ground to receive the grains or seeds, spreads in said furrows the seeds at equidistant intervals, together with the manure necessary for their successive dvelopment, and then covers the seeds and the manure spread in the bottoms of the furrows.

MOTOR-PLOW.—H. J. Kyle, Tipton, Ind. The improvement pertains to plows such as used upon farms for tilling the soil. The object of the invention is to produce a plow which will be advanced by a motor carried on the framework thereof. Special objects are to provide operating mechanism which is of simple construction and which enables the operation of the plow to be easily controlled by a person not skilled in mechanical arts.

BINDER ATTACHMENT.—A. Williams, Joliet, Mont. In the present patent the invention is an improvement in self-binding harvesters, and it has for an object the provision of a novel construction by which to collect and save the grain and grass-seed which are ordinarily wasted off the deck of the binder.

PLOW.—S. S. Weaver, Carrollton, Mo. The invention relates particularly to a plow intended for preparing the soil for seed, in which plow means are provided for acting on the subsoil at the bottom of the furrow. The object is to provide a device which may be readily attached to existing plows of this class and by means of which the subsoil may be effectively cultivated and furrows prepared for the reception of the seed.

BALE BINDER AND TIER.—W. C. Morgans and T. Gilloon, Dubuque, Iowa. It is intended that the device is to be mounted upon the frame of any power baler or one that has a self-feeding arrangement, and it is so arranged that the power may be taken from any shaft of the baler, according to the style and construction thereof. The invention saves time, increases the capacity of the baler, saves the service of tying, saves in the length of wire and therefore its cost.

DEVICE FOR LOADING SUGAR-CANE.—G. D. Luce, New Orleans, La. A loading attachment to carts and other vehicles for loading sugar-cane or like material is provided by this inventor. The device includes a permanently-attached standard adapted to receive removable cranes, which cranes are provided with grapples and with means for raising and lowering the grapples and operating their trips, together with means for swinging the cranes on their supports, the cranes being independent in their action.

Of General Interest.

STEAM-TRAP.—W. Bletso, Youngstown, Ohio. This improvement relates to a trap of that class in which the steam and water of condensation are entered into a chamber the outlet of which is sealed by a valve and in which when the water attains a certain height in the chamber the valve is opened and the steam-pressure is permitted to discharge the liquid contents of the chamber. Primarily the object is to improve the general design of the trap and provide means for effectually and rapidly operating the discharge-trap.

EXTENSIBLE HANDLE.—D. Lawson, New York, N. Y. In the present patent the invention has reference to extensible handles—such, for instance, as are used upon shovels and analogous implements for handling coal, and also admitting of general use in instances where longitudinal cylindrical handles are employed. The length of the handles can be changed by the operator at comparatively short intervals.

SELF-FASTENING COTTON-MARKER.—G. W. Long, Lindsay, Ind. Ter. This invention pertains to improvements in cotton markers, its object being to provide a device which will be self-fastening and one which is simple, cheap, and efficient, one which will remain in place when once attached to a bale of cotton, etc.

MARINE VESSEL.—J. E. Johnson, Ishpeming, Mich. The object of this invention is to provide means for propelling marine vessels which will at the same time decrease the resistance offered by the hull to this propulsion. The inventor provides peculiarly-arranged propeller-shafts mounted diagonally on the vessel with respect to water-line and carrying propellers at their lower ends, so that upon the rotation of the shafts the propellers exert a combined lifting and propelling force on the hull, causing it to displace less water, and enabling it to be driven with less resistance.

GARMENT-SUPPORTER.—H. F. Niles, Chicago, Ill. In this case the invention pertains to supports for garments, and more particularly to belt-suspenders for trousers. Its principal objects are to provide a concealed support for such garments as hip-trousers which shall be effective, comfortable, and readily adjustable to the wearer and garment.

DISPLAY DEVICE FOR MILLINERY ARTICLES.—H. Silberman, New York, N. Y. The invention has reference more especially to devices for displaying millinery articles, as ladies' hats and the like, in stores and show-windows and other places; and one of the principal objects thereof is to provide a device of this class which is comparatively inexpensive to manufacture, besides being thoroughly reliable for its purpose and possessing the capacity for long and continued service.

RAZOR-BLADE HOLDER.—J. H. Hunt, Massillon, Ohio. The purpose of the improvement is to provide a readily-operated holder for the blades of safety-razors when it is necessary to hone or strop the same, and, furthermore, to so construct the holder that the blade can be quickly and conveniently introduced into the holder or removed and held firmly between the jaws of the holder during the sharpening process without the use of set-screws or their equivalents.

RAZOR-STROP.—G. W. Collins, St. Joseph, Mo. Mr. Collins has found in his experience that many persons who use razors constantly injure them by an improper use of the ordinary swinging strop. The object of the invention is to construct a strop in such a manner that this cannot be done. He avoids the disadvantages of those strops which have been formed of rigidly-connected straps that could not be adjusted with respect to each other or the supporting means employed.

COMBINED CIGAR CUTTER AND LIGHTER.—W. H. Crawford, Cliftonforge, Va. The invention is an improvement in combined cigar cutters and lighters. The device is entirely automatic in its operation, performs its cycle of movements in proper sequence and always returns the burner into position under the extinguishing-hood, thus preventing waste of fuel from failure to extinguish the flame.

DEVICE FOR TEACHING PENMANSHIP.—R. W. Manuel, Minneapolis, Minn. An envelop is employed for containing used and unused practice-sheets to be used by pupils, and means for attaching to the back of envelop a plurality of copy-slips having samples to be followed in any order when practicing examples given. Back of envelop is utilized as a writing-base, upon which practice-sheets are placed. As each line of a practice-sheet is filled out the sheet may be pushed forwardly to temporarily conceal such lines and to bring next succeeding line adjacent to lower edge of the copy-sheet being followed, until all lines of the practice-sheet have been utilized, thus preventing mistakes in copying their writing instead of the exercise on the slip.

UMBRELLA ATTACHMENT.—Margeret A. Brunner, New York, N. Y. In using the device the umbrella is stood near the person and a portion of his garment at a convenient point is placed between inwardly-projecting teeth, whereupon the body of a tassel is slid in the direction to lock the claw to the garment. Rising without noticing the umbrella it will tug at the garment as he moves and he will be apprised that the article is forgotten. It has substantially the appearance of an ordinary umbrella tassel.

COMPUTING DEVICE.—G. M. Brown, Otto, N. Y. The invention refers to a device for rapidly determining the value of a certain line of goods at a given price without mathematical calculation, and has for its object to produce a device of this character which will have a very large range both in respect to the prices and quantities, which will be very compact in structure and which will be so simple as to render mistakes impossible.

PIPE-WRENCH.—L. V. Remion, San Bernardino, Cal. This wrench is designed especially for use in oil-fields, as in the putting down of pipe-lines. The invention is simple in construction yet efficient in operation, and no complicated mechanism forms part of the wrench. The handles are easily detached. Hence the wrench may be used in a limited space, and when the pipes are properly seated and started power may be used to turn it by means of a belt engaging the wheel-sections. The sections are removable.

HOSE-COUPLING.—M. L. Scanlon, J. S. Scanlon and A. A. Arnold, Galion, Ohio. In this patent the invention has reference to means for rendering hose and pipe couplings water, air, and steam tight. The object had in view by the inventors is the provision of a coupling of this character which shall not only be adapted for effecting an improved coupling of the parts, but be simple of construction and easy to operate.

LINE-FASTENER.—D. W. Robbins, New York, N. Y. This device is an improvement for securing the ends of and taking up the slack

of clothes-lines or the like, the object being to provide one that will be simple and inexpensive in construction and by means of which the slack of the line may be easily taken up and secured.

CONCRETE-BLOCK MOLD.—J. MCL. PETTYJOHN, Terre Haute, Ind. The invention relates to molds more particularly intended for use in the manufacture of concrete into blocks commonly used in place of ordinary brick and heavy stone blocks, and the inventor's object is to obviate certain objections to similar molds as now constructed, such as with some thereof the block must be removed by lifting or lowering action from the mold and with other forms there is much liability of marring the corners, etc., of the block when removing the mold from the block.

LUNA FOR HOLDING THE HOST.—H. F. NEHR, New York, N. Y. One purpose of the invention is to construct a luna in which the host is visible from the front and the back and wherein when the luna is opened the host or wafer will be so supported on the back member of the luna that it can be readily removed by the officiating divine.

FOLDING BABY-CARRIAGE AND CRADLE.—I. ANDREWS, New York, N. Y. The purpose here is to provide a construction which will permit the carriage to be compactly folded when not required, and to provide a construction which permits the carriage body being given a rocking motion, adapting it for use as a cradle, and also to so construct the conveyance that it will be simple, durable, and capable of convenient and expeditious operation.

V-BLOCK.—R. BLAZEJ, New York, N. Y. The object of this inventor is to provide a V-block with an attachment enabling a shaft to be drilled transversely with absolute certainty and to render the attachment adjustable to shafts of various diameters. This he attains by providing a peculiar gage-bar adapted to lie over the block on the top of the shaft and connected with the block by means of slides mounted thereon. In connection with the block he uses a support having certain peculiar connection with the block, enabling its position to be adjusted at will.

ATTACHMENT FOR CHAIRS.—VIRGINIA M. HOLLYDAY, Baltimore, Md. This attachment is for chairs for facilitating conversation between persons of impaired hearing. Speaking-tubes are applied to a double chair or seat, which is preferably of the vis-à-vis type, in such manner that persons seated on opposite sides of the central support between the seats may converse by means of the tubes while supported comfortably and even while their hands may be used for work, since they are not required to support a mouthpiece or ear-tube.

SUPPORT FOR HOISTING DEVICES.—L. GREENKY, New York, N. Y. The object of this invention is to provide a support for hoisting devices, arranged to form a permanent part of the building, to permit convenient attachment and support of the hoisting-tackle employed for hoisting pianos, safes, furniture, and other heavy articles up to a window and through it into a room of the building, and also for use by painters and other mechanics for supporting scaffolds, etc.

COIL-SPRING.—E. HOGAN, Portland, Ore. Some of the many advantages of Mr. Hogan's invention are, it is made all complete with loops, hooks, eyes, snaps, rings, etc., of one unbroken piece of rod or wire; it has four rods or wires, two from each end, passing through the coil to support it, and as they are fastened around last coil opposite each other the strain or tension is the same from each end on two sides of spring. and it gives strength, durability, and efficiency with economy in construction.

EGG-CARRIER.—N. H. CLARK and R. L. CLARK, Munnsville, N. Y. The invention provides a carrier whose body-section consists of a receptacle having partitions forming a series of pockets, each adapted to receive an egg. The cover for the package is in the form of a tray, together with a locking device for the cover, forming a portion of the carrier body, which device holds the tray-cover in place during transportation, whereby upon releasing the device and inverting the carrier eggs will be received by the tray and when the carrier body is removed from said tray-cover the latter will continue to act as a receptacle for the contents of the carrier.

PIANO-REPAIRER'S TOOL.—S. M. KING, Marion, Ind. In this case the invention is an improvement in devices for use by piano-repairers, and has for an object to provide a simple construction for use in polishing and cleaning rust from the tune-pins and that portion of the piano-strings which is coiled around the pins and becomes rusted when the pins rust.

Heating and Lighting.

AIR-HEATING SYSTEM.—F. S. LAMSON, Washington, D. C. Mr. Lamson provides a heat receiving and radiating medium; regulates fresh air supply and retards its movement from radiator to receive desired temperature before escaping; superheats mixed gas and air in the burner before combustion and air furnished exterior to the flame; regulates amount of gas used and air heated by opening and closing the register; provides ingress of cool and egress of heated air through the one register-plate; provides continuing flame when register is closed, from which burners may be lighted upon opening of and extinguished by the closing of the register; prevents escape of gas when the flame is not burning; and incloses the system to conserve and utilize the heating power of the fuel.

RANGE CONSTRUCTION.—M. F. ALLEN, Nashville, Tenn. This invention relates to improvements in the construction of ranges, the bodies of which are formed of steel or other metal. The construction of the stove or range is greatly simplified, and yet the strength and durability are increased. Further, the inventor is enabled to add to the range a hot-water reservoir by the expenditure of but a nominal amount of labor and material.

Household Utilities.

WINDOW-BLIND SLAT-FASTENER. — M. J. COOGAN, Port Chester, N. Y. In this instance the invention pertains to improvements in window-blinds, the object being to provide a simple and novel means whereby the upper and lower sets of slats will be simultaneously operated and locked in closed position or at any desired opening.

Machines and Mechanical Devices.

ORE-CONCENTRATOR.—G. M. WHITNEY, Lawson, Col. The invention refers more especially to that class of ore-concentrators in which an inclined reciprocatory bed or table is employed over which pulverized quartz or sand containing mineral is sorted by gravity and discharged therefrom. One of the principal objects is to provide an apparatus in which the quartz may be subjected to such action as to liberate all the minerals without losing the fine particles of minerals known as "slimes," thus making the separation complete at one operation and discharging the ore automatically.

MILL.—H. A. HOWARD, Sherburne, N. Y. The object of this invention is to overcome the disadvantage in "attrition-mills" where the discharge is clogged, not only causing the mill to drive hard, but also to heat, and therefore injure, the material to be ground. To attain this end Mr. Howard provides a peculiar clearing member or members attached to and rotating with the grinding-heads and located outward from their peripheries, by which means to produce peripheral air-currents, tending to disclose the accumulations referred to and also tending to mechanically scrape or clear away the accumulations.

CONCRETE-BLOCK MACHINE. — J. A. BLAKE and J. KENRICH, Wolcott, Ind. In this machine a circular series of mold-boxes is arranged and to one side of the same there are mounted upper and lower press-heads between which the mold-boxes are adapted to be brought in succession. Suitable operating devices cause the press-heads at the proper time to move respectively against the top and bottom of the mold-box. The mold-boxes and core-blocks employed herewith employ novel features looking to the quick formation of the concrete block and its removal when finished.

TYPE-WRITING MACHINE.—J. A. HAGERSTROM, New York, N. Y. One of the purposes of the inventor is to provide a construction of type-levers and a manner of pivoting them whereby each type lever or bar will have an extended bearing, insuring accuracy in printing action and stability in all positions, the bearings being so constructed that while extended the type bars or levers can be arranged the conventional distance apart, all striking at a common center.

GLASS-WORKING MACHINE.—J. NORTH, Lancaster, Ohio. The invention relates to machines for producing glass articles, and more particularly of those for drawing tubes and cylinders. The means employed results in the production of a tube of fixed diameter and by virtue of the constancy of speed secured by a controller said tube will be of uniform quality. The machine is exceedingly simple and convenient to operate.

TYPE-DISTRIBUTING MECHANISM.—H. C. HENSEL, Chicago, Ill. This improvement insures exact registry of pockets, and consequently rapid and reliable type distribution. The mechanism gives the moving part of the type-distributing mechanism not only its usual step-by-step movement from pocket to pocket, but one or more additional and very slight movements when pocket is reached, so that if when moving parts halt at a pocket registry is not then exact a slight additional movement or movements is given to moving part, whereby to bring pockets into exact registry. These additional movements are necessarily minute and the interval is arranged to be sufficient to allow type to drop freely.

Prime Movers and Their Accessories.

ROTARY EXPLOSION-ENGINE.—P. BARTOLETTI, Brownsville, Pa. In the present patent the object of the invention is the provision of a new and improved rotary explosion-engine arranged to give impulses in quick succession to the piston-heads of the engine with the view to impart a continuous, powerful, and uniform rotary motion to the piston.

STEAM-VALVE.—J. D. AUSTIN and E. N. AUSTIN, Campbell Hill, Ill. The invention pertains to improvements in valves for controlling the admission of steam or other motive agent to an engine-cylinder, the object being to provide a valve of novel and simple construction and by the operation of which the ports leading to the cylinder will remain entirely open until the piston nearly completes its movement, thus resulting in an economy of power.

Pertaining to Recreation.

ARTIFICIAL BAIT.—J. L. ACKERMAN, Monticello, Ind. The invention contemplates constructing an artificial bait with a body comprising two separate sections fitting face to face, together with means for securing said sections. Sections of bait may be made of wood or other material with a plate held between and provided with hooks for securing the fish-hooks. Different forms of wire devices in connection with one of the bait sections are adapted to be held in grooves or otherwise in the body sections and having portions to which the fish-hooks may be connected. The invention comprehends use of sectional body with interposed device—such as the plate or wires for securing the fish-hooks.

Pertaining to Vehicles.

WHEEL.—G. L. HINSCH, Waverly, Iowa. The invention refers to improvements in wheels for vehicles—such as motor-cars, automobiles, machinery-wheels, and pulleys, and the like—the object being to provide a wheel with a spring-yielding hub, so as to relieve the vehicle, machinery, or pulley from undue shock and jar while in motion or while making sudden stops or starts and also obviating the use of pneumatic tires on vehicle-wheels.

DESIGN FOR A PLATE.—C. E. ZIEGLER, Limoges, Haute Vienne, France, This beautiful design gives the plate a circular form. The surface or top edge presents a slightly raised scroll work of six sections, each of which contributes to an outer edge of graceful bow-shaped curves.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 7835.—For Canadian manufacturers of coal cars.

Inventors and Manufacturers.—I design and make drawings for all kinds of Tools, Dies, special Labor-saving Machines, and estimate cost of same.
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Inquiry No. 7836.—Wanted, address of party making the "Talking Electrical Sign," as exhibited at the Pan-American Exhibition.

For Sale or to Manufacture on Royalty.—Patent No. 766,976. Support for Press Drills. No agents. For information or model apply F. P. Shek, 875 Myrtle Ave., Brooklyn, N. Y.

Inquiry No. 7837.—Wanted, addresses of parties making metal button-making machines, machines for blading, polishing and cleaning cutlery goods; also factories making watches, spectacles, photographic materials and novelties.

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Inquiry No. 7839.—For manufacturers of perforated music for mechanical piano player.

Inquiry No. 7840.—For manufacturers of stage arc lamps and accessories.

Inquiry No. 7841.—For parties using willow wood in diameters up to 20 inches.

Inquiry No. 7842.—For manufacturers of machinery for making banana flour.

Inquiry No. 7843.—For manufacturers of Portland cement containing no oxide of iron.

Inquiry No. 7844.—For manufacturers of transferable designs; also dealers in chemicals and drugs.

Inquiry No. 7845.—For addresses of hardwood lumber companies.

Inquiry No. 7846.—For manufacturers of small turbine water wheels.

Inquiry No. 7847.—For manufacturers of coffee roasters that will roast or cook 90 pounds of coffee and 45 pounds of sugar until the sugar is burned into the coffee.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
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Minerals sent for examination should be distinctly marked or labeled.

(9884) E. E. W. asks: In corresponding with an electrical dealer about hand-power for running a 75-watt dynamo, he said that it could not be run by hand-power, it was too large. This dynamo at 1,400 R. P. M. will furnish 15 to 20 volts; at 2,000 R. P. M. will furnish 40 to 50 volts. In a circular I have there is a 75-watt dynamo advertised. This dynamo will furnish an alternating and direct current at the same time or separate. It will run as a motor on a direct current and at the same time furnish an alternating current to light lamps by. In all other respects it is the same except in design. The questions in my mind are why cannot the first dynamo be run by hand-power if the one can that I last described? Does it take more power to run a dynamo as you increase the amount of current or the voltage? If a dynamo is run at a higher speed than it was designed to run, would there be a higher voltage or amperage? A. A 75-watt dynamo can be run by hand, by one-man power, for awhile. It is one-tenth horse-power. And a strong man can exert more power than that for a short time. It matters not how the 75 watts are made up—1 ampere at 75 volts, or 3 amperes at 25 volts, or any combination which gives 75 for a product. Power is in watts, and these are the product of volts and amperes. If the speed of a dynamo is increased the volts are increased, but the amperes remain the same. All the amperes flow which the resistance allows to flow. The volts depend upon the rate of cutting lines of force by the revolving armature. This is increased by increased speed. But if 1,400 turns per minute give 15 volts, 2,000 turns per minute can only give 22 volts, and not 40 volts as you give it.

(9885) S. L. D. asks: In your column "Answers to Inquiries" will you oblige a 45-year reader of the SCIENTIFIC AMERICAN by stating scientists' explanation of the great weight of the earth? Astronomers say the whole weight is 5½ times that of water: viz., about 344 pounds per cubic foot. Marble and the densest granite rarely exceed 180 pounds per cubic foot. By far the largest part of the earth known to man is much less in weight than granite; for example, water, earths of all kinds, coal, all woods, etc. If astronomers are correct, a few hundred miles down and thence to the center of the earth there must be great density of matter. A. It is true that the average density of the materials on the earth's surface is not greater than three times that of water. The weight of a cubic foot of such materials then is not far from 180 pounds per cubic foot. Your inference is the only possible one, that the interior of the earth is much heavier than the surface portions. Nor is this any different from what would be expected, if once the earth were fluid. At that time the heavier substances sank to the bottom of the fluid mass, and are at present nearer the center of the earth.

(9886) B. E. H. asks: 1. Imagine a tunnel through the center of the earth. If an iron ball was dropped into it, where would the ball come at rest? A. If there was nothing to impede or deflect a falling ball from its path down a hole drilled through the center of the earth, it would go to the surface on the opposite side and then fall back again to its starting point, and never come to rest. If only the resistance of the air were taken into account, the ball would fall to and fro a less distance each time, and ultimately come to rest at the center of the earth. 2. Please give me the formula for making a sal-ammoniac battery. A. For an ordinary LeClanche cell dissolve four or five ounces of sal-ammoniac in water enough for the cell and pour it in.

(9887) H. D. G. asks: Desire an opinion on a question that probably is an old one, that certainly admits of a correct solution. If it were twice as cold as two degrees above zero, how cold would it be? Fahr. computation. A. Degrees measured from the ordinary zero of a thermometer do not express the relative amount of heat or cold. To do this the degrees must be counted from the absolute zero, which in the Fahrenheit scale is 459 degrees below ordinary zero. In this scale 2 degrees above the common zero is 461 degrees above absolute zero. Twice as cold as this, or better, half as hot, is 230.5 degrees above absolute zero. It would be expressed as 230.5 degrees absolute Fahr.

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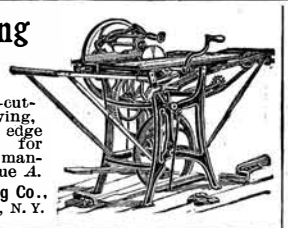

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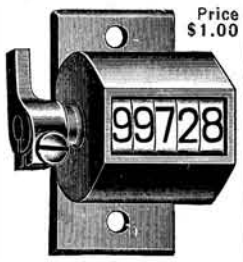

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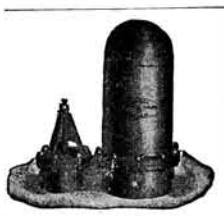

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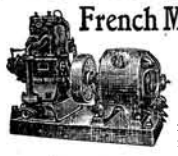

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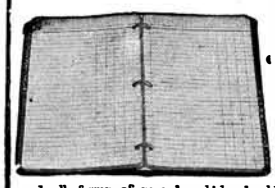

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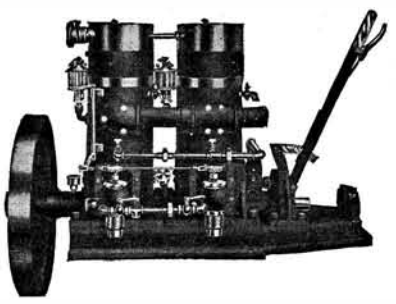

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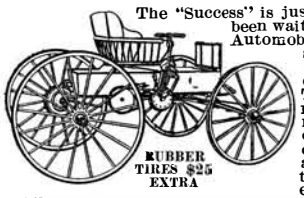

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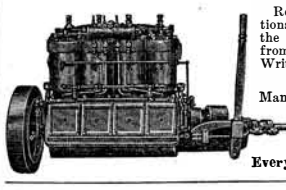

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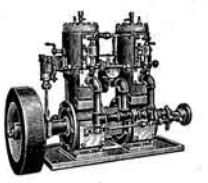

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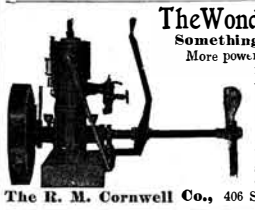

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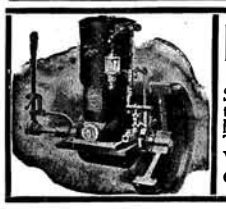

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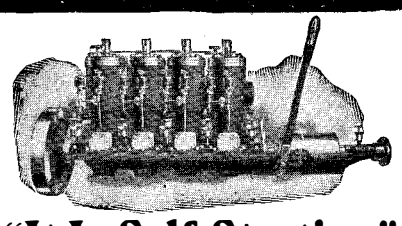

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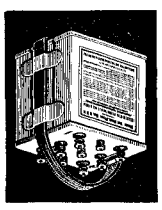

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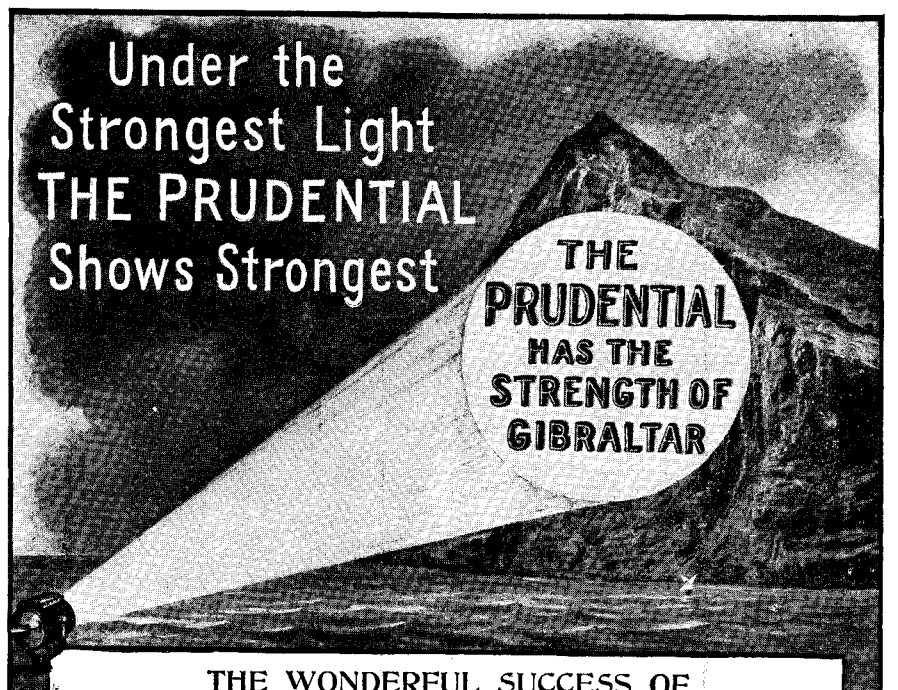

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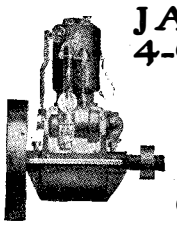

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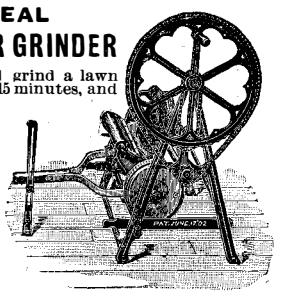

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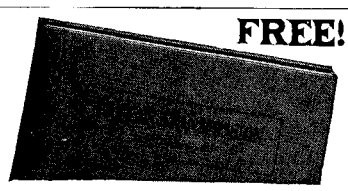

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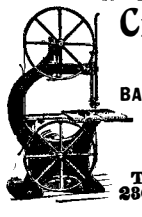

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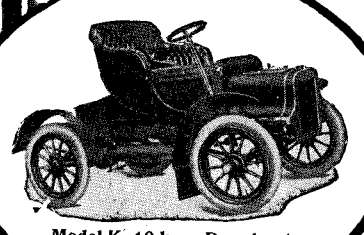

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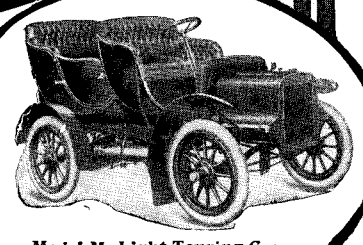

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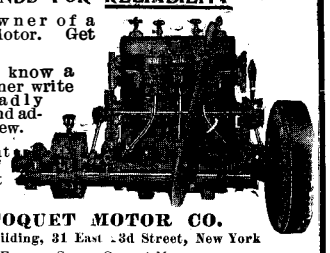

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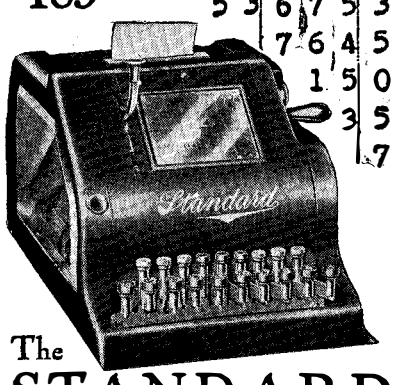

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			7	6	4	5	1	¼
				1	5	0	1	½
					3	5	3	¼
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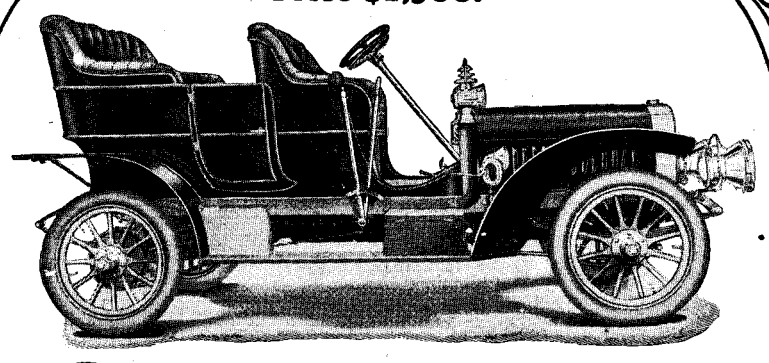

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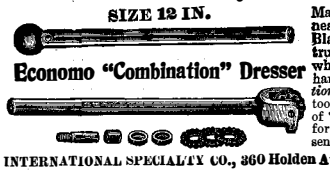

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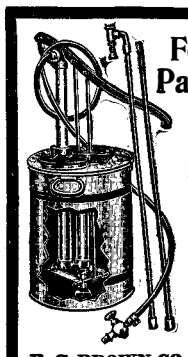

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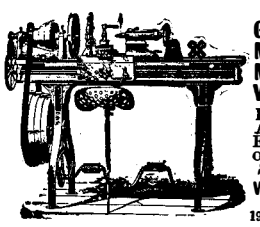

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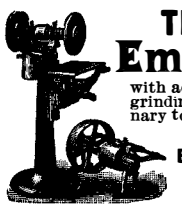

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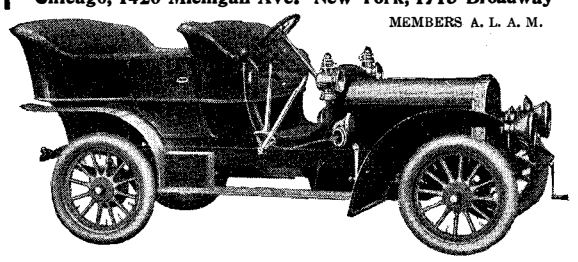

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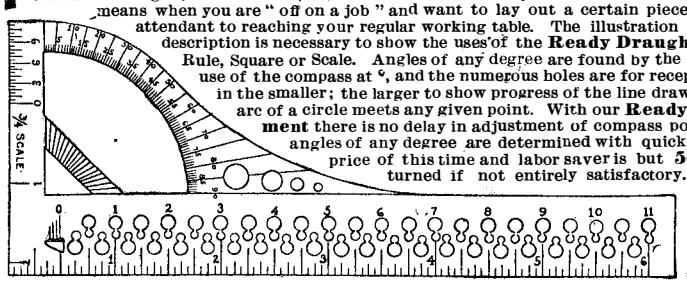

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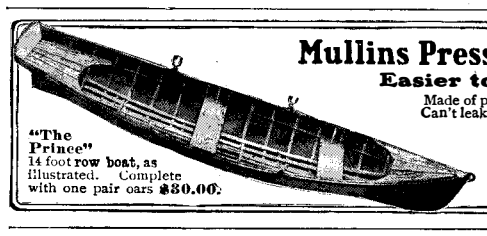

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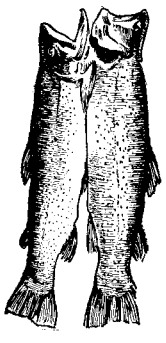

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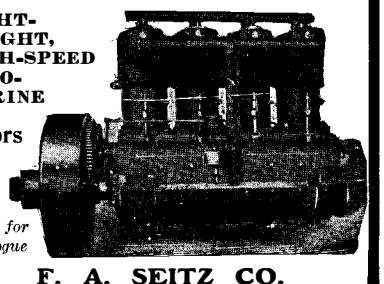

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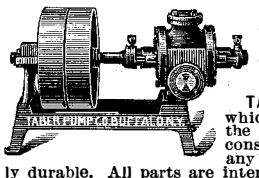

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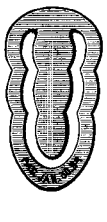

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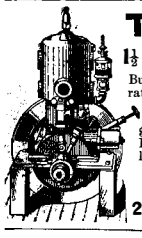

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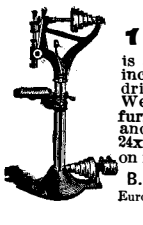

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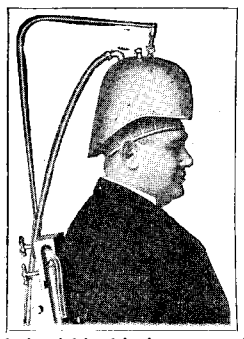

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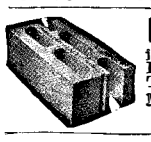

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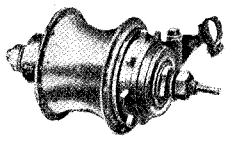

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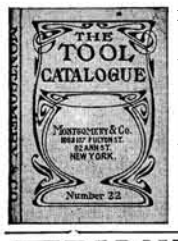

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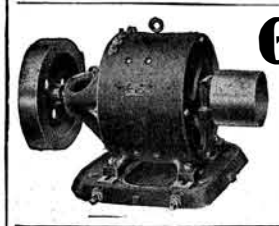

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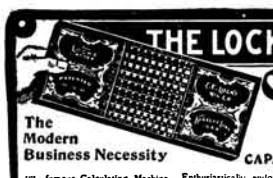

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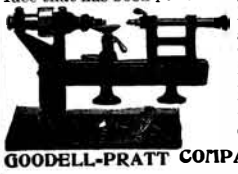

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